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TOWN SCAVENGING AND REFUSE DISPOSAL.

REFUSE COLLECTION AND DISPOSAL.

By Hugh S. Watson, A. M. I. C. E., London, Eng.

WASTE Paper Service.—Many towns have now adopted the system of attaching galvanized wire baskets to the bases of electric light standards or lamp-posts, in which waste paper may be deposited. The contents of these are in some cases emptied into the ordinary collecting carts which collect the street refuse. In others a separate collection is made, and the paper so collected is sold.

In Liverpool 406 tons of paper were collected in the year 1906 in baskets of this description, and this was sold at the rate of 12/6 ($3) a ton, the total receipts for the year being £254 ($1,232), while the cost of collection was £151 ($732), the net profit being £103 ($500). Councillor Muirhead, of Liverpool, when speaking at the Annual Conference of the Institute of Cleansing Superintendents of Great Britain and Ireland, in 1908, stated that the net profit from this source had amounted to about £300 ($1,500); presumably this referred to the year 1907.

In Glasgow a separate collection of waste paper is made. Bags for holding the paper are issued to offices; other business premises and better class dwelling houses, and are called for as often as necessary. Covered vans are used for the collection of the waste paper. In his last annual report Mr. D. M'Coll, the cleansing superintendent, states that the amount realized from the special watse paper service amounted to £640.16.7 ($3,108).

In Newcastle-upon-Tyne 32 boys are employed solely to pick up paper from the streets, and in 1906 about 150 tons was collected in this manner, the whole of which was destroyed. A separate paper collection is made from shops and business premises, the amount collected being about 220 sacks per day. This is sorted by girls, put into pressed bales and sold. During the year 1906 the quantity disposed of was 340 tons, which realized roughly £300 ($1,500) at a small margin of profit.

Collection of House Refuse.—This is in all cases carried out in the day time, the work being started early in the morning. Although the by-laws of the London County Council only provide for the collection of house refuse once a week, it is the general custom of sanitary authorities in London and in many provincial towns to make a daily collection, where the necessity for the same arises, as for instance in the case of hotels, factories, restaurants and markets. Where a daily collection is in force the inhabitants are generally required to use covered galvanized iron bins and to place them on the edge of the curb in front of their premises. In many boroughs in London the commissioner of police requires that the refuse shall be removed from certain streets by 10 A. M., on account of the obstruction caused to traffic.

Where the collections are only made weekly, the bins must be placed in accessible positions, from which they can be removed by the dustmen. They are generally placed in the areas in front of houses, where such exist, and in the case of shops they are often retained in the cellars and passed up through trap doors, opening onto the street, a small lift being used to raise the bins.

In Liverpool a special form of bin designed by Mr. Brodie, the city engineer, is in use. This consists of a cast iron frame, which is built into the back passage wall of the premises. The bin itself fit into the frame, and projects slightly into the yard, so that ashes and refuse can be easily deposited therein. To remove the receptacle it is necessary to use a special handle which engages with studs projecting on either side of the bin.

In some towns special air-tight bins

are supplied for the reception of refuse from butchers and fishmongers' premises.

There are two methods of collection in common use. One is to send out carts singly, under the control of drivers only, who are provided with small receptacles into which they may empty a part of the contents of any house bin that they may find too much for their strength. The other is to send the carts out in pairs, accompanied by an additional scavenger. When the first cart has been filled it is taken by the driver to the nearest depot, the scavenger remaining behind to assist in the filling of the second cart. If the distance from the place of collection to the depot is not very far, the first cart should have returned by the time the second cart has been filled. When the carts have to travel long distances, however, this system will not be found economical, as the scavenger will be standing idle during the time the carts are both absent.

As a rule the whole of the contents of the house bins are emptied direct into the carts, and any sorting that may be performed, to recover articles having a marketable value, is carried out at the disposal works. Occasionally, however, baskets are slung on to the backs of the carts, in which tins and scrap iron, etc., may be placed at the time of collection, so as to save any subsequent sorting.

It is usual to place a little disinfectant in each bin after it has been emptied.

Mr. Allen Vickers, the cleansing superintendent, has found that in the borough of Battersea a van holding 2½ cubic yards can take the contents of about 68 portable bins, that is to say, that one cubic foot of refuse is removed from each bin.

The vans work in gangs of four, a helper being attached to every two vans, and they make an average of 3 loads per day, so that each van can deal roughly with the refuse of about 200 tenements.

Removal of Trade Refuse.—Under the Public Health Act, London, 1891, sanitary authorities are required to remove trade refuse from any premises when requested to do so by the owner or occupier, but the owner or occupier shall pay for the removal of such matter. In the City of London a charge of 7/6 ($1.80) per ton is made for removing refuse from the various markets. In the Metropolitan borough of Finsbury trade refuse is disposed of at the rate of 2d (4 cents) a bushel if collected from private premises, and 1d (2 cents) a bushel if deposited at the local authority's depot. The term "trade refuse" includes the droppings from costermongers' barrows and stalls, for which they are made to pay at the above rates. A charge of 2d (4 cents) per cwt. for quantities weighing less than 10 cwt. and 2/— (24 cents) per ton for quantities of over 10 cwt. is made for the disposal of trade refuse in Salford, but an exception is made in connection with the green grocers and fish trade, in order that these tradesmen may not be encouraged to store this refuse, and thus create a nuisance and a danger to the public health. Refuse from these forms of business is destroyed free of charge when it is brought to the depots.

"Trade refuse" is defined under the act as "refuse of any trade, manufacture, or of any building materials," but it is very difficult to state exactly what comes under these terms. It appears, however, that no refuse is considered as trade refuse unless a direct profit is made from the matter of which the refuse removed is merely the waste.

Disposal of Street Refuse.—Road sweepings are disposed of in a variety of manners. In many towns the street sweepings are used as manure in the public parks and gardens, and the surplus that cannot be disposed of in this manner is either sold or given to farmers, who use it for the same purpose.

Much of the road sweepings of London is barged to the mouth of the river, and is utilized to fill up the holes from which brick earth has been removed, in the various brick-fields situated thereabouts. The land at the mouth of the river is, generally speaking, very low lying, so that the level is generally made up considerably higher than the original level in order to prevent flooding. The ground is allowed to run wild for a year or two, and is afterwards put into cultivation, when splendid crops can be taken off it.

In some seaside towns, such as Dover, the proportion of road sweepings which cannot be disposed of or utilized as manure is conveyed to sea. In the year 1904, of 8,491 loads collected, 1,679 were disposed of in this manner.

In very few cases are road sweepings dealt with at destructor works, owing to the difficulty of burning them, particularly in wet weather, when they consist largely of slop. If the sweepings have to be barged or railed, it is advisable, generally, to store the material for a short time previously, in order to allow any water to drain away.

NEW STATISTICS OF CITIES BY THE CENSUS DEPARTMENT.

By Don E. Mowry, Madison, Wis.

EDANA DURAND, Director of the Census, has just issued the abstract of the annual report on statistics of cities having a population of over 30,000 for the year 1907. This report contains the more important data relating to the activities of municipal governments, and is published in advance of the detailed report, which will appear in the near future. In addition to the tables presented in the abstract, the detailed report will contain 30 tables for the detailed presentation and analysis of the financial data, together with 25 tables relating to departmental equipments, employes and activities. The abstract was prepared under the supervision of Mr. Le Grand Powers, chief statistician in charge of official statistics of cities.

The sixteen tables of the abstract present, in a comparable form, the following data relating to the financial transactions and conditions of municipalities: The total and per capita costs of government and the similar costs of maintaining specified public services; the total costs of constructing and maintaining sewers, streets, etc., and the average cost per standard unit of work performed; the total and per capita revenue derived from all sources and from each specified source; and the proportion of the total revenue derived from each source, and the total expenditudes made for each object or purpose.

Great differences were found to exist in the organization of American cities for purpose of local self-government. In some cities practically all municipal activities are administered by a city government having one executive head and a single set of financial officers, the various departments of municipal activity in such cases being subject to one control or supervision, and all persons engaged therein receiving their compensation through the same channel. In other cities the administration of municipal functions is distributed among a number of more or less independent but correlated branches or bodies, of which the one performing the most important functions is usually spoken of as the city corporation.

The government of the city—that is, of the community constituting the city—for which data were obtained in order to compile comparable statistics of financial transactions and conditions, was not limited to the "city corporation," but included all corporations, organizations, commissions, boards, and other authorities through which the people of the city exercised any privilege of local self-government, or by which they enjoyed the exclusive benefits of any governmental function.

For purposes of comparison, the cities are grouped in four classes, as in former reports on cities. I includes cities with a population of 300,000 or over; II, 100,000 to 300,000; III, 50,000 to 100,000; and IV, 30,000 to 50,000.

In order to bring out the value of these yearly reports, which the Census Bureau has been issuing, I have gone over the present abstract with a view of making some comparisons in nine of our leading cities, namely, Baltimore, Cleveland, Buffalo, Pittsburg, Detroit, Cincinnati, Milwaukee, New Orleans and Washington, D. C.

Baltimore is the largest city of the group (over 553,000), but there are five other cities that have a greater total area in acres. The total outlay per capita is smaller than it is in six of the other cities. New Orleans is the only city that spends more for health and sanitation. For highways and education Baltimore's per capita outlay is small. Her recreation and public service outlays are among the best. The outstanding gross debt is smaller than that of Cincinnati—and Cincinnati's population, in 1907, was about 350,000. Baltimore's net debt per capita at the close of the year was smaller than that of Cincinnati and New Orleans. Pittsburg has a greater assessed valuation. The police force of Baltimore is the largest in the group. More arrests, for all causes, were made in Pittsburg. The Baltimore appropriation for the fire department was considerably more than that made in any other city, yet Buffalo, Pittsburg and Detroit employed more men in this branch of the city service.

From the rough table which I have before mé similar comparisons might be made for all of the cities of this group which I have selected at random. However, I believe I have illustrated the value of these government statistics to those who are interested in mak-

ing these comparisons in the interest of their own city. I will therefore cite only some of the salient features which my table, based upon the abstract, reveals:

Cleveland has a large number of arrests in proportion to her population. Buffalo spends the least for health, sanitation and recreation. Pittsburg employs the largest number of men in her fire department and spends the most money for all general and special services. Detroit's gross and net debt outstanding at the close of the year is nearly as small as that of Milwaukee. While Cincinnati spends the most for education, due, in part, to the fact that she is largely responsible for the upkeep of the University of Cincinnati, her debt is far in excess of any other city of her own size. Milwaukee still leads in the lowest number of arrests, the lowest per capita outlay and the lowest gross and net debt outstanding at the close of the year. New Orleans has the largest per capita outlay and spends the most money per capita for public service enterprises. She spends the least for police protection and only 0.50 per cent. per capita on her highways. Washington spends the most for her highways because she has the greatest area, nearly double the amount of any other city in the group. Her outlay for health, sanitation and education is considerable.

If you are interested in the pavements of cities you will want to examine Table 15 of the abstract. Buffalo has more asphalt and asphalt block area than either Washington or San Francisco. In Cleveland there is less of this sort of pavement than in any of the nine cities mentioned in the group I have chosen for this brief analysis. Milwaukee has the greatest area of macadam, over five million square yards. Baltimore has an equal amount of cobble stone. Cleveland takes first rank for area in brick paved streets, and Pittsburg for granite and Belgian block streets. Nevertheless, Pittsburg has more miles of unimproved streets than any of the other cities. In this same connection it is interesting to note that Cleveland has abolished the largest number of grade crossings during the year.

The abstract which I have before me is Bulletin No. 105, and any one who is interested in the statistical facts presented can secure a copy of the same by writing to E. Dana Durand, Director of the Census, at Washington, who, I am sure, will be glad to mail the report if the supply is not already exhausted.

REINFORCED CONCRETE BRIDGES FOR COUNTRY ROADS.

By J. G. McMillan, C. E., County Surveyor. San Jose, Cal.

CONCRETE bridges are rapidly replacing the old style wooden and steel bridges, which formerly were a conspicuous but not altogether an attractive part of our county roads. The wooden bridge is no longer seriously considered by a wide-awake board of supervisors which realizes the many advantages of a reinforced concrete or cement structure.

There is no field of construction in which the use of concrete appeals more strongly to the practical business sense of the farmer than the building of highway bridges. The flimsy and unsightly bridge structures of wood and steel are really more expensive in the end than bridges and culverts of concrete, which are at once beautiful, permanent and fireproof and require no painting or repairs. The somewhat higher initial cost of concrete bridges in some localities has retarded their adoption, but the vastly superior advantages of concrete cannot fail to ultimately impress the intelligent judgment of American farmers generally.

Concrete bridges were initiated into Santa Clara county in 1891, the first being a four-ring brick arch laid in Portland cement mortar, the side walls and foundation being of gravel concrete and boulders. There was one span, 36 feet long, with a 24-foot roadway. At the time the contract was let for this bridge, bids were also received on other plans, viz.: Two bids for a wooden bridge, $490 and $681; also one bid for a combination bridge, $690, and one bid for a wooden bridge with concrete piers for $971. The bid with concrete structure was for $1,025. The contract was let for $1,000, the deduction being made in consideration that

CONCRETE BRIDGE OVER LOS GATOS CREEK AT ALMA.

Cost $2,843. Span 40 feet. Roadway 20 feet.

the contractor leave off the plaster finish on the concrete structure.

There are in Santa Clara county between thirty-five and forty concrete and stone bridges of more than 20 feet span.

The designs are made in harmony with the locality.

In the foothills and mountains, where boulders and field stones are available, they are worked into the structure not only for harmony, but also as a matter of economy. With the proper use of boulders and field stones a saving can be made in labor and cement of 25 to 30 per cent.

Up to 1902 most of the arches were constructed of brick, laid in cement mortar; nevertheless, plans were submitted and bids received both on brick arches and reinforced concrete arches. Until 1904 the cost was in favor of the brick arch, since which time the cost has been in favor of reinforced concrete.

From 1891 to 1904 the cost of concrete, where sand and gravel were close by, was $5.50 to $6.50 per cubic yard; in 1907 and 1908 the cost ran up to $10 per cubic yard.

All the stone and concrete bridges withstood the earthquake of 1906, whereas many of the steel and combination spans were moved from their foundations.

So far all expense for maintenance has been eliminated.

In the East and Middle West many of the county boards are going on record as champions of concrete bridges in preference to all other materials. In Kansas recently the senate passed a bill which provides that the county boards throughout the State must build concrete or stone bridges in all cases where the cost of a concrete or stone bridge is not more than 30 per cent. in excess of the cost of a steel bridge. This notable piece of legislation is a most striking recognition of the merits of concrete and evidence of the growing conviction that this kind of material is the most satisfactory for bridge construction.

EDITORIAL NOTE.—We are indebted to Mr. McMillan and to *The Architect and Engineer* for the accompanying photographs.

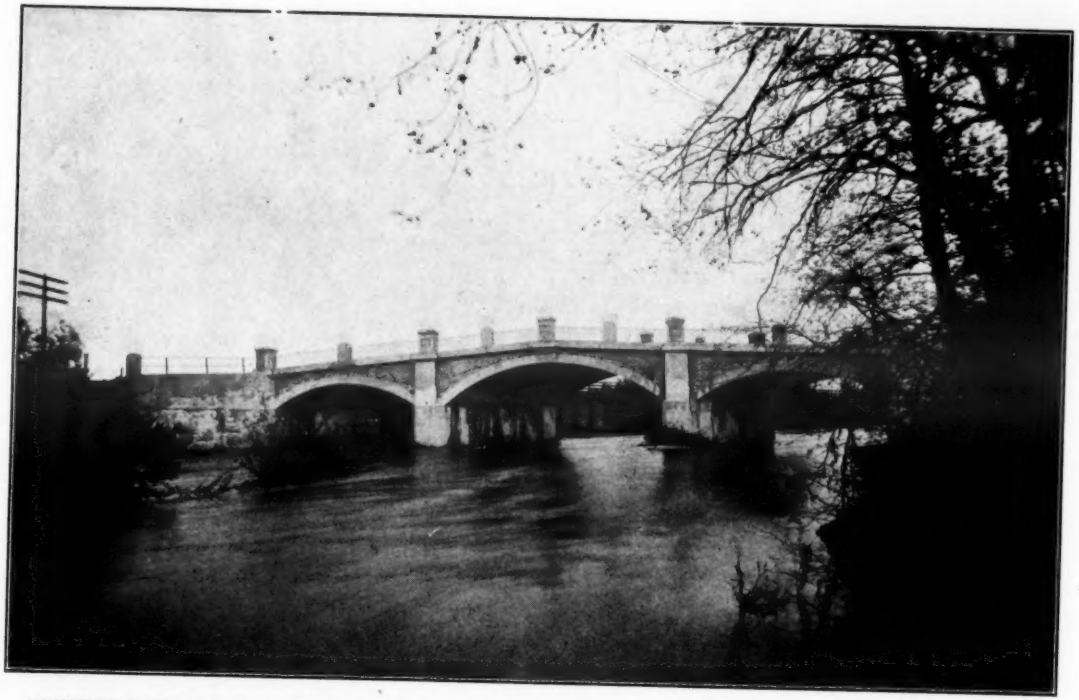
PAVING BLOCK INSPECTION AT THE MANUFACTURING PLANT.*

By W. A. Aiken, M. Am. Soc. C.E., Vice-Pres. Henry S. Spackman Eng. Co., Philadelphia, Pa.

EARLY in the spring of 1909 a contract was made for about two and one-half million paving block by the city of Kingston, N. Y., and the Spackman Engineering Company was employed through a specially appointed committee of the authorities to take charge of the inspection of the material, as well as to lend the author's experience towards the proper execution of the contract for placing the material, to the end that as nearly as possible first-class results should be secured. One marked incident showing appreciation of the value of our experienced service is to be noticed in the request by the local civil service board of Kingston, that the writer draw up the examination papers whereon depended the securing of specially authorized inspectors on the construction, with the result that a number of high class, honest, earnest young men were secured, who as far as possible carried out the intentions of the specifications of the city engineer. One of the first steps taken by the writer of the paper was to place in the hands of those having the care of the construction, copies of your Mr. Blair's pamphlets on pavement construction. While it is not always possible, even though theoretically it should be so, to insure the best, the earnest effort to obtain this must always, as noticeable in this case, give better results than where work is carried on without every safeguard. This is only possible through the employment of disinterested outside parties, to represent public interests irrespective of political factions, which necessarily exist in every community and whose influence, unfortunately, is not always of the best.

The first step in our inspection work was to install at the brick plant a National Brick Manufacturers' Association standard rattling machine. Considerable stock of previous season's manufactured block was tested to determine the permissibility of its use,

*From a paper before the National Paving Brick Manufacturers' Association.



CONCRET EBRIDGE OVER THE CARNADERO CREEK ON THE MONTEREY ROAD NEAR GILROY, CAL.
Cost $12,300.

as undoubtedly contemplated originally by the contractors, which probably largely influenced the authorities of the city of Kingston to provide for such inspection. The product so tested did not prove acceptable, with the result that all block going into the Kingston Broadway improvement was manufactured during the season in which the work was constructed and under our general supervision.

A close study of kiln conditions was early undertaken to determine the height zone therein from which it was likely the better material could be obtained, but, while some general data were accumulated, it was found at the plant in question that not as much positive dependence could be placed on the location of the brick in the kiln as was originally hoped, so as to expedite the sorting and loading of the block. It finally settled down to the manufacturer loading direct from the kilns onto barges, all transportation between the manufacturing site and Kingston being by water, of such material as in his judgment would, by average sample selected therefrom, by ourselves, pass the requirements of the specifications, which called for a maximum abrasion loss of 18 per cent and a maximum absorption of 3 per cent. The question of testing is always more or less a give-and-take proposition. Like all other material, nothing could be absolutely assured unless every block was tested, which, of course, would destroy its usefulness. As the work progressed and the acceptable kiln output was reduced, much dissatisfaction was expressed by the manufacturer at what was claimed to be the rigidness of the inspection, but the samples selected by our representative were never claimed to be unrepresentative and were taken by ourselves only from loaded material culled by him to meet the specifications.

The blocks from each kiln as opened were piled separately on barges, reports of the abrasion tests were regularly forwarded, generally previous to shipment of the material from the brick plant, by our representative to the city engineer at Kingston and an additional ten blocks from each kiln were sent to our Philadelphia laboratory for cross breaking tests for modulus of rupture and specific gravity determination, as well as absorption test. This latter was as severe as need be, being made on the halves of the cross brick which had previously been put through the rattling machine for a certain time to insure approximately specification conditions for each absorption test, viz.: rattled brick.

The question of character of shot material incidentally loomed up on two or three occasions when the brick manufacturers failed to keep a supply of standard shot, and others of specification size and weight, though not of specification quality, were temporarily furnished from local foundries. In one case, chilled material was furnished and the effect of the harder surfaced shot was at once apparent in discordant results on material, which, in our representative's as well as the writer's opinion, should not have been found if the shot had been of standard quality.

Since the object of the inspection was to insure good material and since no specifications should be interpreted to the entire waivure of experienced judgment, some latitude was allowed when such did not necessarily involve the acceptance of poor material. At times material was loaded and shipment made from the last kiln being tested before results were obtained, and under such circumstances samples of the material involved were returned to our representative by the city engineer, with whom final appeal necessarily rested, for additional retests, if the original ones had been unsatisfactory. This only occurred in exceptional cases, and in one resulted in the acceptance of the material, which on original tests would have been rejected, and in others, the retests corroborating original test, resulted in the rejection of the delivered material. Each barge load was diagrammed by our resident inspector, facilitating the selection of material for retests when necessary and the city engineer did not allow the unloading of any material until final action had been taken thereon based on our reports and recommendations.

The advantages of the above described inspection service may be summed up briefly: It insured a supply of accepted material on the work, by preventing the shipment, as a rule, of any block not finally acted upon through tests made before shipment. This obviously is of the greatest advantage to the contractor engaged in laying the pavement by enabling him to make his plans for carrying on the work through knowing in advance the quantity of material he could count upon and obviating the delay incidental to waiting for action on material to be tested after it has been received. It is of as great advantage

CONCRETE BRIDGE OVER SAN FRANCISQUITO CREEK ON POPE STREET, PALO ALTO.
Cost $3,825. Span 50 feet. Roadway 28 feet.

to the block manufacturer in minimizing any loss for rehandling or freight charges both ways, as when material is not tested until after delivery and is subsequently rejected, but far and above this, and of immeasurably more value, it enables him to keep a line on his product and through the daily tests being made on material, involving even possibly slight variations in raw product or details of manufacture, either accidental or intentional, insures the best finished product, providing the resident inspector is, as he should be, an experienced observer, and the manufacturer is prepared to take advantage of all the information to be garnered from these test results. It is of equally great advantage to the municipality's engineer and his corps of inspectors, who, under these ideal conditions, are not obliged to be worried by the constant vigilance necessary to keep rejected material off the work or to prevent any delivery on the work until final test action has been taken. These inspectors are thereby enabled to devote their entire attention to the carrying out of the details of construction as called for by the specifications.

There is no doubt that if inspection at the point of manufacture was generally adopted by municipal authorities, or even by general contractors purchasing block material, through the employment of outside specialists to insure the shipment of nothing but accepted material, thousands of dollars could be saved to all interested parties — the manufacturer, the contractor and the municipality for whom the pavement is to be constructed— through saving in freight charges to the first, possible handling charges to the second, and expediting construction in the case of the two last. The expense amply warrants the adoption of inspection at the manufacturing point. This has been proven in the case of cement inspection, first advanced and adopted by the writer as general inspector of material on the New York subway and now so very largely carried on everywhere in the case of this material, and is herein demonstrated to have been valuable in the case of paving block.

Many interesting features involved in the question of testing paving block were continually noticed during our six months' engagement, only one of which is above referred to, the influence of the quality of the shot material upon final test results. Testing must be resorted to in order to insure quality. Whether the standard tests are those best qualified to accomplish this and whether the present specification requirements are properly correlated, is questionable and certainly open to argument, since many factors are of influence; but as long as certain requirements are admittedly the standards to be met, the effort to comply therewith can most successfully be carried out by intelligent inspection.

PAVING ALONG STREET RAILWAY TRACKS.*

By Thomas B. McMath, Chief Engineer Indianapolis Traction and Terminal Company.

THE pavement in street railway tracks is subject to additional destructive conditions besides those encountered on ordinary streets. The concentrated wheel loads of the modern cars distort and deflect the rail. This breaks any contact the pavement may have with the rail and provides entrance for water into the body of the paving. Heavy, stiff rail with good fastenings and solid ballast reduce deterioration of the paving, but do not prevent the vibration of the rail. This cannot be eliminated.

During the past year in Indianapolis several features in track paving have been studied. The reconstruction of track in the business center of the city presented opportunity for improving the track construction. Two blocks of track on Pennsylvania street between Washington and Ohio streets were rebuilt, using every care to make the work as permanent as possible.

The 9-inch girder rail, 90 pounds to the yard, was laid on 6 by 8-inch white oak ties, spaced 2 feet. The subgrade was excavated to a depth of 10 inches below the bottom of the ties and rolled till compact. The track was raised on blocking to the proper grade and line and the excavation filled with Portland cement concrete to within 5 inches of the top of the rail and allowed to set for ten days. Brick surface was applied on a sand cushion. At the street

*From a paper before the Central Electric Railway Association.

BRIDGE OVER LLAGAS AT OLD GILROY.

Span 32 feet. Roadway 20 feet. Cost $2,950. Built 1902.

intersection where traffic could not be kept off, the brick was filled with asphaltum filler. The balance of the paving was grouted with Portland cement, every effort being made to fill the joints completely with grout.

The new features of this track construction are the increased thickness of Portland concrete base under the ties, and the use of the beveled edge Nelsonville stretcher brick outside of the track.

Objection may be made to the use of the stretcher brick outside the rail, as this may start a rut along the rail. The bevel stretcher in combination with the wood strip under the head of the rail is intended to keep the rail from direct contact with the brick and to reduce the effect of vibration and prevent the paving being crushed by wide tread wheels.

Asphaltum filler has been used on brick paving in Indianapolis and has its advantages in cases where traffic cannot be kept off the paving or tracks for sufficient time to permit cement grout to fully set. Several makes of asphaltum filler have been tried, as well as coal tar pitch. Later we will have some data as to their relative merits.

About 8,000 square yards of brick paving was filled with asphaltum filler during 1908. This paving is subjected to heavy traffic and great effort was made to do as good a job as possible. The work was done with every precaution suggested by the representative of the asphaltum, the city engineer, and the engineering department of the street railway to make it first class. Two blocks of the same stretch of track are grouted with Portland cement. A direct comparison of results can be made. At present both stretches of paving are in fine shape.

The wear on brick paving starts from the breaking of the edges of the brick at the joints, rounding the edges till the brick resemble cobble stones. This is noticed especially when the wear is from the shoes of the animals, the wear from wheels being practically uniform across the face of the brick. The round edge commonly used is a mistake. Brick should have as little rounding as possible on the edges.

The greatest possible effort should be made to fill the joints full with the best grout. Ordinary grouting is the ruin of a brick. Five cents a square yard spent on good grouting is the best investment on the job. In going over pavement it will be seen that the best paving is that in which the grouting is best. The city engineer and myself have seen parts of brick pavement that have kept smooth under heavy traffic when the balance of the paving was worn rough; the only explanation for the different condition was the grouting.

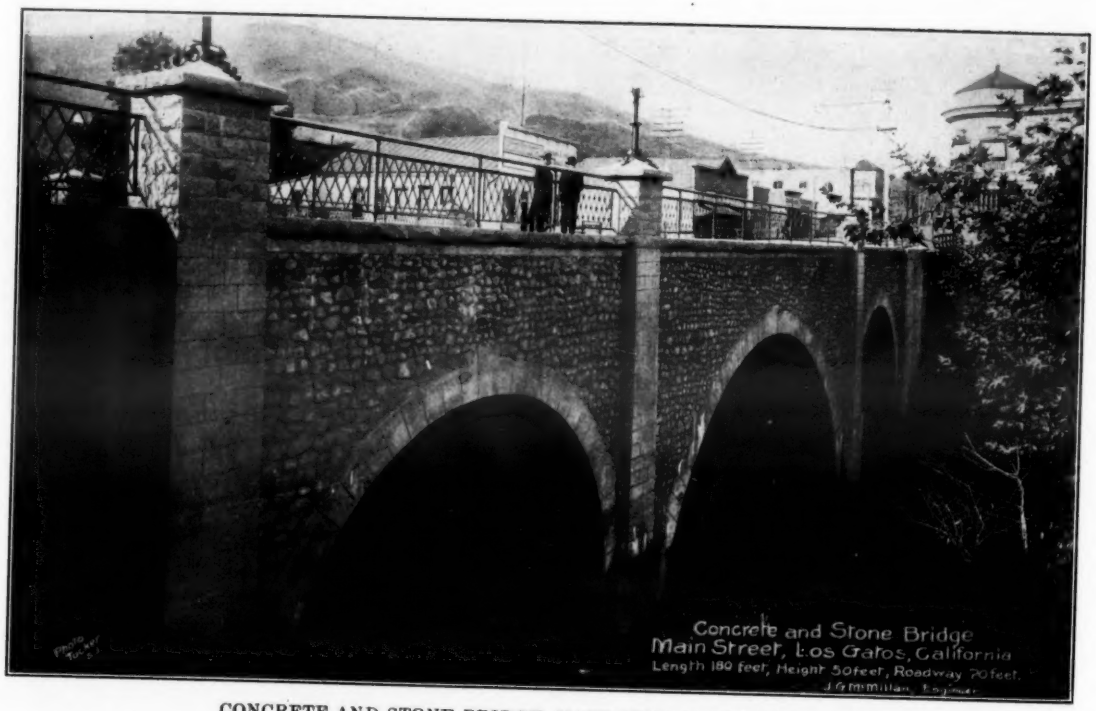
The following method is suggested for grouting: Mix 1 to 1 cement and sand in a box, using always a measured amount of sand, cement and water. Mix thoroughly and dump the box. Sweep the grout on diagonal lines and use a rubber squilgee instead of a broom. After the grout has settled down in the joint go over it again, repeating until the joint is full and flush after the initial set.

The price paid for brick is probably too low; a smaller brick more uniform in structure and burn is preferable. Such brick should be very closely inspected; possibly 40 per cent of the brick now classed as No. 1 should be rejected. If the size were smaller, these brick would be used in building, thus providing against loss to the maker. The manufacturer should grade his product to give the customer the qualities needed and himself reject the poor brick.

Inspection for quality as the brick are laid is unjust to both parties. As the eye can only decide shape, color and possibly absorption of water, many brick that would be satisfactory are rejected and unsatisfactory brick are scattered throughout the paving. The inspector should have the advantage of judging the brick from their position in the kiln. A better market for second-class brick will have to be found before the manufacturer can be expected to grade closer or else the price must be better. Both the manufacturer and his customer should be insured against the expense of freight, unloading, hauling and storage on rejected brick.

Up to the present time no granite or stone block pavement has been used in Indianapolis. The traffic, however, on several streets now paved with brick is so heavy that a block pavement is needed. The street railway has 8,000 square yards of block pavement under construction on Kentucky avenue south of White river.

The block selected is from quarries sixty miles east of Pittsburg and known as Ligonier block. This is a very tough limestone. The block is laid on concrete foundation and the joints filled with pitch. The pitch to be used will be hydrolene 80 per cent and residuum oil 20 per cent. The


Concrete and Stone Bridge
Main Street, Los Gatos, California
Length 180 feet, Height 50 feet, Roadway 70 feet.
J.G. McMillan, Engineer.

CONCRETE AND STONE BRIDGE, MAIN STREET, LOS GATOS, CAL.
J. G. McMillan, Engineer.

stone blocks are smoothly cut and the pavement will not be materially rougher than brick. The block does not glaze nor get slippery under traffic. Block will eventually cobble where exposed only to horse travel, but if laid smooth will remain so under wheel traffic if fully grouted. The secret of a good block pavement is in the cutting of the blocks with smooth faces and square edges; the block must be laid close with the joints filled with filler. If the pavement be as smooth as brick, the noise would be obviated largely and the pavement would continue smooth even when worn by traffic.

For railway track paving, stone block has the great advantage that the paving can be replaced after track repairs at small expense and the general condition of the street is not impaired as in asphalt or brick surface.

The maintenance of track and paving always presents the difficulty that a minor repair to track cannot be made without a large paving expense. In other cases reconstruction of the paving cannot be made because the condition of the track will not justify it and enough money to rebuild both is not at hand. In other words, a worn-out pavement on a street with a two-thirds worn-out track presents a difficult financial problem. There should be some cheap pavement invented to use for such short time work. This problem is frequently presented on interurban lines in small towns in which ordinary tee-rail construction should be paved.

The success of pavements of the bitulithic class seems to indicate that something can be expected in this direction. Assuming that the track roadbed is good enough for a foundation, if a 4 or 5-inch layer of bituminous macadam could be cheaply laid and cheaply and easily be repaired by ordinary section men, it would solve this trouble. The patents seem to tend to prevent the use of the usual forms of such pavements under these conditions.

One proposition of this kind is presented by an asphalt contractor. He suggests a layer of clean macadam laid and rolled in place with a light roller, then poured with a hot asphalt. This is to be followed with a layer of ¼-inch stone also poured with hot asphalt, then coated with sand and cement and rolled with a heavy roller.

For this proposition no great plant would be required. A closed heating kettle of two tons capacity with a hand agitator can be purchased for $700. The grading of the macadam can be cheaply done. It has been estimated that such a pavement could be laid at 50 cents per square yard, and subsequent patching could be done by section men at the same cost. This would give a pavement suitable for light traveled streets where the traffic largely avoids the car tracks. The cost of maintenance would be so small that it would not be neglected.

THE DEEP WELL WATER SUPPLY OF SOUTH BEND, INDIANA.*

By Alonzo J. Hammond, Consulting Engineer, South Bend, Ind.

OF the valuable assets which have been given by a kind providence to many of the cities of Indiana, the one of perhaps the most value is a supply of pure water from deep or artesian wells, and the one city peculiarly favored is South Bend.

Many of the cities which have depended on their deep well supply for a number of years have found the flow gradually decreasing, the effective head growing less, placing a greater burden on the pumps for a suction lift, in many cases requiring some type of deep well pump to force the water from a depth below the limit of suction of the piston pump, and requiring the drilling of new wells over a wider field, but it is particularly true that the static head has become less, and the field is fertile for the air lift, the centrifugal or screw pump which can be put into a small well casing.

The wells found along the St. Joseph river in northern Indiana have a strong hydrostatic pressure, those in South Bend particularly so.

By some strange upheaval during the glacial period, the course of the St. Joseph river was changed from a southwesterly direction through the Kankakee and the Illinois river drainage system to a northwesterly route, reaching Lake Michigan for an outlet.

Heavy deposits of gravel are found at and near South Bend, and along the

*A Paper before the Indiana Engineering Society.

LONG BRIDGE ON SARATOGA TURNPIKE.
Cost $8,347. Two 60-foot Arches.

river channel an average vertical section penetrating the water-bearing gravel may be as follows, this being a vertical section of a ten-inch well drilled in 1906 at the Central station. Measuring down from the surface, there is fourteen feet of top soil, then fifty-nine feet of impervious blue clay of a fine texture, which material has been largely used in the manufacture of building and paving brick, burning white. Below the clay is nine feet of compact sand, and then twenty-eight feet of coarse gravel, which is water bearing, make a total depth of 110 feet. This section is typical only, as the actual depths and thicknesses of the different strata vary widely, and the total depths vary from 85 feet to 125 feet.

The source of water supply to this stratum of gravel has been conjectural, one assumption being that it is supplied from gravel deposits lying northeasterly from the city, another that its source is the river, the percolation going on at some point well up the river from South Bend.

It is barely possible that the latter theory is correct, and that the stratum leading to the one at South Bend is very limited in extent, because of the fact that numerous borings a few miles above have so far failed to locate any similar supply of water.

The following data as to the static head of the wells indicate a gradual dropping off of hydrostatic pressure as the location of the wells is carried down stream.

At Springbrook Park, about two miles above the central station (and I may say that the central station is within one block of the business center of the city), the static head of a two-inch well is at an elevation of 32.00 city datum. At the central pumping station the static head is 28.00 city datum; at the north pumping station, which is about 3,000 feet below the central, the static head is 27.00 city datum; at Terrace avenue, which is the lower city limits, the static head in a test well was 22.00 city datum, and at St. Mary's, which is three miles below the central station, the static head is 4.00 city datum. This shows a total drop of 28 feet in head within the five miles, which, to my mind, indicates a source of supply from the east, and possibly the river as that source.

The gravel in which the well points stop is very coarse, carrying some sand, but it is believed to be sufficiently open and porous to permit of a relatively high rate of flow.

The blanket of impervious clay not only prevents any possible contamination of the supply, but protects and maintains the pressure from below.

The limit of width of the water-bearing gravel is not well defined, as a sufficient number of wells has not been drilled to outline the limits on each side of the river, but during some recent tests at the central station, when the head in the wells was pulled down much below the normal level, some influence was felt at two wells, one located east of the river and the other west, being about 3,000 feet apart.

If this width of gravel should be maintained for the full length of the river within the city limits, with an average depth of gravel of 20 feet, a storage capacity for water is provided in this gravel bed of three thousand million gallons of water.

The first pumping plant put in and placed in operation in 1873 pumped river water, but it was later discovered that the station site was underlaid with this artesian supply of water, and by 1886 some 25 wells were drilled, using 4-inch and 6-inch pipe.

Some difficulty was had with water coming up between the clay and the pipe as the pipes were pushed through the clay stratum, but an outer casing was adopted, driven into the clay some fifteen or twenty feet, and the annular space was plugged.

The number of wells at the central station has been increased, so that now there are in use nine 4-inch wells, fourteen 6-inch wells, four 8-inch wells and six 10-inch wells. The wells vary in depth from 110 feet to 125 feet.

The supply being limited by the small ground area owned by the city at the central station, a new station site was obtained within the city limits and about 3,000 feet down stream from the old station, and a contract made in 1895 for the drilling of thirty wells 6 inches in diameter. These wells have an average depth of 85 feet and the screens project into the gravel about 12 feet.

The first three wells were located about seventy feet apart, and the water from the first well drilled flowed about eleven feet above the ground and some twenty feet above the river at a normal stage. A test was made at the time of the flow of the first five wells, the first three being seventy feet apart and the last two being 100 feet apart.

The test on each well with the others not flowing was as follows, as shown by a weir measurement, the rate of flow being for 24 hours and the

flow due to the natural hydrostatic head or pressure:

Well No. 1.....475,950 gallons per day
Well No. 2.....462,240 gallons per day
Well No. 3.....470,880 gallons per day
Well No. 4.....588,380 gallons per day
Well No. 5.....508,030 gallons per day

Another test of flow was made to determine the influence of the wells on each other, and the result of this test was as follows:

With gates closed on		Gallons per day
1, 2, 3, 4,	Well No. 5 flowed....	564,768
1, 2, 3,	Well No. 4 flowed....	588,380
1, 2,	Well No. 3 flowed....	392,250
1,	Well No. 2 flowed....	359,420
With gates all open		
	Well No. 1 flowed....	331,770

A loss on well No. 1 of 30 per cent. is noted when the adjacent wells are all open over what its flow was when they were all closed. The direct influence of the wells on each other of the 16 located within the reservoir within an area of about 3,600 square feet is very great, and the results of the tests show an exceedingly great dropping off of the average flow due to such influence.

During 1908, in order to test the condition of the wells at the central station, a small piston pump was attached to the individual wells and the pump speeded up until the vacuum gauge on the pump read up to about 25 inches, with the following results on the 16 wells lying within the reservoir at the central station:

Discharge from weil	Gallons per day
No. 15—6-inch well.....	384,400
No. 16—6-inch well.....	406,000
No. 17—6-inch well.....	159,800
No. 18—4-inch well.....	95,000
No. 19—6-inch well.....	159,800
No. 20—6-inch well.....	126,700
No. 21—6-inch well.....	69,100
No. 22—8-inch well.....	112,300
No. 23—4-inch well.....	360,000
No. 24—6-inch well.....	273,600
No. 25—8-inch well.....	177,100
No. 26—6-inch well.....	234,700
No. 27—6-inch well.....	294,200
No. 28—6-inch well.....	318,800
No. 29—4-inch well.....	360,000
No. 30—6-inch well.....	384,000
	3,915,500
Adding for wells 31-36, outside	687,500
Makes total, wells tested...	4,603,000

The arrangement of suction mains is such at the central station that a two and one-half million gallon pump may be and usually is connected direct with these twenty wells, and at times it has been difficult to pull a vacuum of 22 inches on the large pump when so connected, so that the shrinkage is very great from the individual well tests to that when they are all pulled on, the variation extending perhaps from 4,600,000 gallons per day to 2,500,000 gallons per day, or nearly 46 per cent.

The results of the test showed three wells as non-producers, and one well had its valve closed, which when opened developed a good flow and a valuable well. After the cutting out of the three wells there was a marked decrease in the air in the suction main.

An interesting phase of the individual tests is shown by comparing well No. 1, which is a 4-inch well, which had presumably been in since 1886, and, pulling a vacuum of 22 inches, the piston pump threw 255 gallons per minute. Well No. 5, which is an 8-inch well and had been in the same time, under a 22-inch vacuum gave a discharge of 283 gallons per minute, while well No. 12, put in during 1906, with a vacuum of 23 inches, developed a discharge of 282 gallons per minute. Or with a variation for a 10-foot screen of a circumferential area of 10 feet for the 4-inch, 21 feet for the 8-inch and 26 feet for the 10-inch, the discharge ranged 255 gallons, 283 and 282, respectively.

There are certain advantages in the use of a ten-inch pipe, but there does not seem to be any direct ratio of increase of discharge from the use of different size pipes, the flow depending rather on the velocity in the gravel stratum of the water reaching the pipe.

No system of locating wells was used at the central station; it was merely a matter of putting a hole down somewhere and somehow, with the expectancy of having the water spurt up with a high pressure, and the effort was successful only because nature had provided a rich reservoir.

At the north station some thought was evidently given to the relationship of the wells, but an idea was advanced that the river had some direct influence on the flow, and some four wells were placed in the river and the most of the others parallel to and along the bank of the river, while the pump house was set some distance away, requiring long suction mains, and small pipes were used to too large an extent in connecting up the suction mains.

The wells were put down with an outer casing extending into the clay; the screens were about 12 feet long and the well pipe was extended up to the surface and capped, the lead to the suction main having a valve at each well.

With thirty 6-inch wells and four 10-inch wells a volume of water at the rate of 9,000,000 gallons per day has been pumped for short periods, but this reaches about the limit with the present layout.

The static head has not been materially reduced during the last fifteen years, and possibly none at all, as the head shown in 1895 was 11 feet above the surface of the ground at a point near the river, while the head measured a year ago was 9 feet above the surface measured at a well nearer the pump house.

The prospect of a continuance of a very efficient supply from this stratum of gravel is so good that the field will be further developed with new wells.

The real difficulty is the lack of reservoir capacity in the small wells to take care of emergency pumping, when all the pumps must be worked up to their capacity, and at such times the head runs off quite rapidly.

To provide against such a contingency, I have recommended the construction of a deep concrete reservoir, to be constructed near the pumps and to form a link in the suction line. The mains leading from and connected to the wells would be carried to the bottom of the reservoir at such a depth as to be entirely below the limit of suction of the pumps, and the intake pipe would draw from the same low level.

During a cessation of pumping, or when there is a normal load, the reservoir would stand full of water and provide a large storage; in the case mentioned a reservoir of one million gallons capacity was designed, and this volume would be ample to care for any sudden draught, as for fires or heavy pulls during the dry season for sprinkling.

The water has, of course, a fairly uniform temperature, and, being free from any source of contamination, the most strict requirements are met as a potable water for domestic use, and it is also very satisfactory for commercial uses, as shown by the following recent analysis, parts in 100,000:

Odor	None
Color	0.0
Turbidity	None
Sediment	None
Free ammonia	.0914
Albuminoid ammonia	.0054
Nitrates	None
Nitrites	.0002
Chlorine	1.4
Total solids	36.6
Fixed solids	29.8
Hardness	24.6
Iron	.001
Colon bacilli	Absent
Lead	None

WATER SUPPLY AND TREATMENT FOR POWER PLANT PURPOSES.*

By William Miller Booth.

THE price of raw material, of fuel, labor conditions and freight rates are important factors to be considered when a new industrial plant is to be built. Less often investigated, yet of primary importance is the presence of a constant supply of good water. If possible two independent sources should be made available.

It is not a large manufacturing concern that requires boilers of 1,000 h.p. capacity. If run 10 hours per day these evaporate approximately 170 tons of water. When condensing engines or turbines are used, from 14 to 17 times as much water is necessary to return the steam again to its original state, or about 2,500 additional tons—in the aggregate more than 9,000 pounds per minute.

The quality of the water is not a matter of indifference, as modern power house apparatus makes exacting demands of the medium passing through and over its parts. It will readily be seen that choice of water requires knowledge of power plant conditions and should not be handled in a haphazard way.

While our population and manufacturing interests constantly increase, available water is decreasing, especially in our small streams that flow through densely settled districts.

Given two sources, the use of that which entails the least cost is nat-

*From a paper before American Waterworks Association.

urally considered—the quality is often neglected. Unfortunately water exactly adapted to boiler use is seldom found in nature.

With a general idea of the strata of a locality a practical geologist can predict with considerable accuracy the quality of water to be found on the surface and in wells.

For convenience we classify waters as follows:

Soft Water:				
From Rain and Snow	Contain:	Ammonia salts	Action:	Corrosive
Granite and quartz rock		Alkali		Negative
Returned		Ammonia		Corrode
Swamps		Organic matter		Corrode
Lakes and large rivers		Calcium and magnesium salts		Slight scale
Hard Water:				
From Springs	Contain:	Lime, magnesia, iron	Action:	Scale forming
Lakes		Sulphates		
Small rivers and creeks		Chlorides		
Wells		Carbonates		
Saline Water:				
From Sea	Contain:	Lime, magnesia	Action:	Scale forming
Wells and mineral springs		Sulphates, chlorides and carbonates of sodium and potassium		Corrosive Foam
Alkaline Water:				
From Streams from Western plains	Contain:	Sodium chlorides, sulphates & carbonates, silica, lime, magnesia	Action:	Foam
Springs				
Acid Water:				
From Mineral springs and wells	Contain:	Hydrogen, sulphide	Action:	Corrode
Coal regions		Iron sulphate and sulphuric acid		

The first group includes rain and snow waters that are free from scale-forming materials, but which contain organic matter and in the first instance may have a strong acid reaction. The use of such waters is attended with danger from pitting. Harder water should always be mixed with these, or a slight excess of alkali may be added.

Precipitated waters flowing over granitic rocks are ideal for boiler use, as enough alkali is absorbed to prevent pitting. Water from wells in the Adirondacks, driven in granite and quartz sand to a depth of sixty feet, was found to possess a hardness varying from .5 to 2 degrees Clark—pure water being unity.

The only distilled water practicable for boiler purposes is that returned from vacuum pans, pumps, engines, turbines, surface condensers and heating systems. Condensed water from turbines containing no oil ought to be ideal for boiler use. We have, however, had an instance of severe corrosion resulting from the use of such water with a proportion of fresh hard water added at each return to the boilers. Returned turbine water should be made slightly alkaline. We believe that the open heater and hot well should be much more generally used and that a good oil separator is indispensable in any large plant. Anxious to keep his apparatus well lubricated the engineer often uses an excess of oil which makes it difficult to utilize the condensed water. A large amount of energy escapes daily from many plants through heated water that runs to waste, in addition to the loss of soft, scale-free boiler water. Many engineers suffer from oil at the surface of the water in the boiler; the gauge glass showing this condition quickly. If mineral oil is used in the power plant we do not worry about the presence of a small quantity in the boiler, but prefer to keep it out.

Another class of soft waters is found in the lowlands of the coast. A heavy rainfall with finely divided organic matter and heat, combine to charge standing water with organic matter which may be acid in character. Boilers using such water suffer from corrosion and require alkali.

The waters of some lakes, large rivers and a few deep wells deposit little scale and may be termed "soft." Arbitrarily we fix the hardness under 3 degrees Clark. Such waters contain suspended particles, sand, clay, leaves and dissolved organic matter, the quantity of these varying greatly during different seasons. These require considerable blowing down at the boiler. Water of this character is improved by sedimentation in large tanks followed by upward filtration through coarse material, as sand, coke breeze or excelsior.

We insist that water for boiler purposes shall be clean. Sewage laden lake or river water carries grease which accumulates upon the headers of water tube boilers and corrodes the tubes and shells of tubular boilers. Our clients are much annoyed by such water. We recommend sedimentation, upward filtration and legal proceedings against the corporation or individual contaminating the stream. This applies particularly to abattoirs, rendering plants, woolen mills and cities. As a last resort we recommend chemical precipitation and filtration.

HARD WATERS.

A large proportion of our water supply is scale forming. If ten grains of this material per gallon are present nearly 140 pounds of sludge and scale will concentrate, in a 24-hour, 1,000 h.p. plant. This badly interferes with the operation of the boiler as a steam producer. In many samples of water, carbonates vary from 3 to 15 grains per gallon and sulphates from a trace to 120 grains per gallon. What these compounds are and how they are formed will not be discussed here.

Organically pure but hard sources of supply are used by many cities and towns to the disadvantage of manufacturers. We have suggested in a previous paper that large operators should combine to manufacture soft water for their common use. Water companies might soften supplies furnished certain districts. We believe that scale-free, clean water is worth ten cents per 1,000 gallons. It usually costs less than three cents to soften this.

Many manufacturers drill deep wells to provide drinking water and to serve as an auxiliary supply. We suggest consultation with a practical geologist before putting a large amount of money into such an enterprise.

Having been fortunate enough to obtain water this may be of any class mentioned in the table. For power plant purposes heavily charged mineral waters are to be avoided. We present an analysis of a well water that is useless for boiler purposes:

Grains per U. S. Gallon. Combined.

Sodium chloride	1.252
Calcium carbonate	16.959
Calcium sulphate	87.462
Magnesium carbonate	.000
Magnesium sulphate	15.555
Magnesium chloride	.000

Calcium and magnesium carbonates and calcium sulphate are scale producers. Chloride of magnesium corrodes metal and sodium chloride accumulates on all semi-heated surfaces. For boiler purposes we have not been troubled by the precipitation of iron found in natural waters. If water from a well contains all of these forms of impurity in any considerable quantity it should not be used for power purposes. Those who drill wells should take samples of the strata and water encountered. Analysis of these will show what veins of the supply are to be avoided and cased out. As an example of the vicissitudes of well-drilling we instance the following:

To 100 ft.—small quantity, soft water.
100 to 600 ft. no water.
At 600 ft. salt; 300 grains per gallon, sodium, magnesium and calcium chlorides, with carbonates and sulphates.
At 900 ft. salt.
900 to 1,200 ft. no water.
1,270 ft. granite rock, no water; drilling suspended.

SALINE WATERS.

Few waters are free from chlorides. Common salt is not considered scale forming, although large quantities are not easily handled, while the chlorides of calcium and magnesium are very objectionable in a boiler. We have found no trace of chlorine in an Adirondack camp supply drawn from a small stream. Water from Oneida Lake, N. Y., did not contain one part of chlorine per million. This lake is 28 miles long and several miles broad. The sample was taken through the ice in the winter.

Wells, springs and streams in the Salina group contain chlorides varying in our experience from traces to 600 grains of salt per gallon. The quantity of chlorine at various localities in central New York westward is as follows:

Canajoharie, 570 ft. under surface	6 grains
Utica, 600 ft. under surface	300 grains
Oneida, 100 ft. under surface	30 grains
Syracuse, 50 ft. under surface	360 grains
Cayuga Lake	2 grains
Seneca Lake	2 grains
Akron, Ohio, 60 ft. under surface	2 grains

Waters in this belt contain also sulphates and carbonates of calcium, magnesium and sodium, the water varying in hardness from 5 degrees to 80 degrees Clark. Such water is found in

Ohio, Ontario, Indiana and Michigan. These ground waters generally need treatment. Shale waters if in higher altitudes are very good with an average hardness of 6 degrees Clark.

We have no remedy to offer for heavily charged saline waters. Evaporation results in choking boilers and condensers. Wells on opposite sides of New York Central tracks at Oneida, N. Y., about 150 feet apart contain respectively 9 and 30 grains of salt per gallon, the first being 96 feet, the second 106 feet in depth. Both waters are used successfully, the first without, the second with softening apparatus. Well water containing one and one-half ounces of salt per gallon and scale forming cannot be used by Syracuse manufacturers to good advantage.

ALKALINE WATERS.

Some waters contain carbonate, chloride and sulphate of soda and potash with perhaps chlorides of calcium and magnesium.

This is particularly true of waters of the western plains and lakes. As an extreme instance we submit the following analysis of a water sent us from a California lake:

Grains per U. S. Gallon.

Silica	14.35
Alumina	trace
Oxide of iron	.00
Calcium carbonate	trace
Magnesium carbonate	.00
Potassium chloride	93.56
Sodium chloride	2754.30
Sodium sulphate	610.50
Sodium carbonate	2573.10
Acid carbonate of soda	248.50

This is a representative of a very bad sample of alkali water, which could not be used for technical purposes.

Our practical experience with alkaline waters has been confined to those artificially produced in Eastern plants by the softening process. If a boiler is clean we find it almost impossible by adding alkali to produce foaming. This has been proved with an excess of soda ash amounting to 50 grains per gallon.

ACID WATERS.

Water from expensive wells sometimes tastes and smells of hydrogen sulphide. If at all strong, engineers will usually not allow such water in their boilers. We believe that, should circumstances warrant the outlay, a heavily charged sulphur water could be successfully prepared for boiler or other industrial use.

Water from the mining districts often contains sulphate of iron. We consider this dangerous water and suggest treatment before use.

Some waters contain free sulphuric acid. Sometimes such water is supplied naturally but generally this is found in sludge from acid plants, coal washers, or refineries. No more dangerous material can find its way into the boiler.

A sample of scale from boilers in a Pennsylvania steel works was practically pure oxide of iron, the result of an acid supply.

We devote the remainder of this article to methods of handling scale-forming, saline, and alkaline waters.

Three principal uses of boilers afford a natural division as follows: marine, locomotive, stationary.

Marine boilers are generally supplied on coast-wise steamers, tugs and harbor craft, with soft water that is obtained at one of the ports at which the vessel touches. As many of the engine cylinders are run without oil the returned water is used again. Trans-Atlantic steam ships are supplied with surface condensers and complete distilling outfits of expensive design and the softened water is used again.

Locomotive boilers represent an enormous horse power and need the best water obtainable. Hard water only can be found on many lines. Sometimes a soft supply is found at one end of a division and hard water at the other. Alternate use keeps the boiler free from scale. Starting and stopping and generally in motion, the alkaline content of a locomotive boiler water must be kept low. With sludge, serious foaming may result through the use of an excess of softening agent. This subject demands immediate attention on the part of all railroads. Western systems have done more in this respect than those in the East.

Our experience with stationary boilers has been divided between shell and water tube types. Methods of water treatment apply in a general way to either, although many disadvantages of hard and muddy water are overcome in water tube boilers.

Engineers in charge of steam plants are usually ignorant of the principles of water purification. This is only partially their fault, as literature for their education has only recently been available. There are many plants the boilers of which cannot be operated a single week without a deposit of scale serious in character and quantity. The most easily procured remedy has been the "compound" furnished at an in-

flated cost. The introduction of the softening plant has widely advertised the fact that lime, soda ash, caustic soda and tri-sodium phosphate are cheap and efficient scale removers. Many an engineer spends the Sabbath day hammering scale only to repeat the operation the Sunday following. This is usually unnecessary, as proper chemical treatment will remove the scale formed and prevent the deposit of more.

The actual cost during the past seven months to keep boilers clean in a 2,000-h.p., 24-hour plant has been less than $15, the hardness of the water being 5 degrees Clark. Caustic soda and soda ash have been used in excess about 2 grains per gallon.

Ideal conditions favor the installation of a standard softening system. We feel, however, that prejudice is so great that it will take at least five years to make these plants popular with engineers who have in many instances received gratituities from compound salesmen, or with managers who cannot see an adequate return for the investment.

We now turn to methods of treatment.

While waiting for a better understanding of the correct thing to do when annoyed by hard water we have adopted the following method which is now used in many plants. Analysis is made of the water supply or supplies; of the water from the heater, from each boiler and from the hot well. In this way we find remarkable conditions. The hardest water that has come to our notice was taken from three water tube boilers: 1. 43 degrees Clark. 2. 85 degrees Clark. 3. 382 degrees Clark.

It is not unusual to find alkalies and scale-forming ingredients concentrated in the boiler water. If the supply has a hardness of 10 degrees Clark, the internal water may have a hardness of twenty, thirty or even forty degrees.

Great stress has been laid on the removal of carbonates by heaters. We find carbonates in most boiler waters and believe that the best heaters may remove 50 to 75 per cent of these. The water circulates too rapidly to favor their deposit and the dissolved gases are occluded under pressure. The concentration of chemical salts in the presence of organic matter may cause serious corrosion. We believe that sulphates of calcium and magnesium may produce or aid in producing the holes that are eaten in feed pipes and flues, heretofore credited to chloride of magnesium, but which we find may occur when none of this chemical is present. Further investigation must be made to determine the exact cause of the foregoing results.

Having proved the presence of concentrated salts in a set of boilers, we suggest to the engineer that he shall "blow down" once in four hours or two or three times per day from one-half to two inches of water. This form of treatment some engineers will not adopt, stating that it will strain their boilers to blow them under full steam pressure; others do this regularly. We have a plant of this kind in mind where there are two 200-h.p. shell boilers that have been blown down under full head of steam perhaps two inches each afternoon for four years with no injurious results.

The scale-forming materials separate in the boiler, the decomposing carbonates rising to the top and forming a light scum, which accumulates on the upper tubes, while the sulphates and precipitating carbonates form a dense, heavy scale on the shell and lower tubes of the boiler. We believe that it is a very good plan to blow out the accumulated sediment in the morning and in the evening, and that considerable scale may be removed from the water surface while the boiler is under full steam pressure, by opening suitable cocks.

Boilers are set in peculiar ways either accidentally or through ignorance. We have found boilers with the blow-off at the rear no less than 4 inches higher than the floor of the boiler at the front. In some boilers the blow-off is found 3 or 4 inches above the lowest point of the shell, and we find engineers who blow their boilers but once per week, putting in from one to five gallons of compound Monday morning, and making this last the entire week, blowing it out at the close of the working day Saturday. Severe scaling or severe corrosion may result from the lack of use of the blow-off valves. If we were running a boiler or a battery of boilers using hard water we would use the blow-off at least three times during the 24 hours. Lack of attention regarding falling scale and accumulating sludge may result in a bad bag or blister of the crown sheet.

If the engineer finds that he cannot handle the sludge through the blow-off valve, (and this the chemist can determine usually in advance), a mixture of alkali should be used in the boiler. This is added with the feed water drop by drop. The quantity bears

but little relation to that prescribed for the same water in a water softening outfit. For instance, the prescription may call for five pounds of soda ash and two pounds of caustic soda per thousand gallons of raw water. If this is placed in the boiler in exact proportion to the number of thousand gallons used the chances are that very severe foaming will result during the coming three days. We prefer to divide the prescription by at least five and then set samples of water taken from the boilers under treatment, making a careful analysis of such treated water. In this way we are able to determine the quantity and amount of chemicals absorbed and those left in solution, also the quantity and amount of scaling material removed, and that left in the water.

The scale that accumulates on the tubes and shell is often useful in determining the kind of treatment that a boiler needs, but this scale may differ materially in composition at different points in the boiler.

The use of boiler compounds containing tannin is determined by black scale, which is a dye formed by the union of tannin and iron at the expense of the boiler itself. We discourage the use of such compounds.

Objections are raised by some engineers to the use of soda ash in boilers. We have yet to find a single instance where soda ash, if used in moderate quantities, even to 50 grains per gallon in excess, has injured a boiler shell or tubes, and would much prefer the use of a small quantity of this material in a boiler water to the use of rain or distilled water, both of which have a highly corrosive effect on iron. Again, some engineers state that soda ash injures gaskets.

During two seasons we have tried this out in a 2,000-h.p. plant where the steam is used for heating houses and office buildings, and although expensive and complicated steam traps, meters, and gaskets are used throughout the system, we have failed to experience any difficulty whatever from this method of treatment.

Having reckoned the amount of caustic lime required to remove carbonates from water for internal treatment, we use a fraction of its equivalent of caustic soda. With carbonic acid this material is changed to sodium carbonate and if sulphates are present a second reaction takes place. A much smaller proportion of soda ash is required than when lime and soda ash are used.

On account of this double action, we believe that caustic soda should be used much more generally in water, as it is more easily handled than lime and as, further, a concentrated solution can be made. After the preparation has been applied and an analysis of the water has been made, it is not difficult to see what changes are necessary. These should be applied at once. Any form of exact treatment for boiler water within or without the boiler, demands the services of an experienced chemist and an interested engineer. An excellent water softening apparatus failed because the engineer in charge would not give it fair treatment.

Those in charge of power plants are usually anxious to learn some of the principles involved in water purification. It has been our practice to supply a regular outfit for their use. This includes the following:

1 glass burette, funnel and filter papers.
1 bottle phenolphthalein solution.
1 bottle methyl orange solution.
1 bottle silver nitrate solution.
1 quart of soap solution with the formula for making up more, and sometimes a bottle of standard decinormal hydro-chloric acid. This apparatus is purchased by the power plant owner, and placed in the engine room. We have been told by one engineer that he would not take one hundred dollars for the little kit of tools provided to determine the processes going on in the boiler water. The number of tests that these men will make and the care and accuracy exercised in making them are surprising. We have gotten up a printed form for permanent records, such being turned in at the office each day.

WATER-SOFTENING PLANTS.

As there are now several forms of water softening apparatus on the market that are entirely efficient the power plant manager and operator have no excuse for using a scale-charged water. With a thousand horse-power or a larger plant and with water about 10 degrees in hardness a water softening outfit can be shown to be an investment paying more than 10 per cent. on its cost and operating expenses. In some instances this percentage may be raised to a point where the whole apparatus will pay for itself within two or three years. There is great prejudice on the part of engineers to the use of softened water, and we have found men who have put in expensive plants of this sort who are not operating them. The reason being that "they're too much bother."

Considering the cost of extra fuel, flues, the cost of opening the boilers, removing scale and poor steaming capacity a scale-free water is a valuable investment. We find plants that are operating with boilers that have not been opened for months, and that are found in a scale-free condition, the water being of a hardness of about 20 degrees Clark per U. S. gallon. Originally we were not sure of the action of caustic lime and soda ash on concrete tanks, but believe that with a carefully constructed tank of this kind no danger whatever will result through the action of the alkali on the cement mass. A tank has been in use for this purpose for three years and is still in first-class condition.

The ideal chemical for softening water is not now available. Calcium, magnesium and the sulphate radical should be removed. Excessive foaming would be avoided and softened water would approximate distilled water in purity.

SUMMARY.

In conclusion we wish to call attention to the following:

To locate at least one constant supply of good boiler water is an important duty of the engineer who lays out a new plant—if more than one supply can be made available every reasonable effort should be made to secure the second.

Water for boiler purposes should be clean and scale-free. Filtration and softening will produce both conditions even though the supply is bad, chloride and alkaline waters excepted.

Money put into a "well" enterprise is a business venture with uncertain results, but is recommended if conditions warrant the expense.

Water companies should give technical aid to large power users if difficulty is experienced with the water furnished; that delivered to manufacturing districts might be softened before distribution.

Resident engineers should be compelled to make daily reports of the condition of the water from their boilers and a competent chemist should be employed in connection with every large power plant.

This association could to good advantage appoint a committee to report on technical methods of water analysis with the official adoption of a provisional method to be used throughout the United States. This branch of practical chemistry is now of great importance to mechanical engineers.

THE TUNGSTEN LAMP AND ITS RELATIONS TO CENTRAL STATIONS.

By George Merrill.

THE object of the following article is to show the effect of the tungsten lamp and its later developments upon commercial interests. As lamp manufacturers, we are as vitally interested in the commercial success of the tungsten lamp upon central station circuits as are the central stations themselves. The tremendous success with which this lamp has so far met is most gratifying to us, and the rapidity with which central stations have adopted it has even exceeded our expectations. We realized, of course, that the lamp would have to prove its cause, which it has very ably done, and, further, that until its merits were thoroughly demonstrated in actual service, the central stations would be very conservative in regard to its use upon their circuits.

At the Atlantic City meeting of the National Electric Light Association last June, two papers, one dealing with the effect of the tungsten lamp on revenues, and the other a report submitted by the lamp committee, recommended to central stations a broad tungsten policy as productive of the best results. Companies were urged to overcome their fear of decreased revenue in connection with the new lamps, as in practically every case it was found that the revenue could be maintained by the new business available as a result of placing the tungsten lamp freely before the consumer. Moreover, a consideration of the ultimate benefits which are sure to follow such a plan should be enough to overcome any fears for the present.

The two papers referred to, the one based largely upon replies to forty questions submitted to a large number of companies throughout the United States and Canada, and the other based on the judgment of several prominent men of the association, who have taken a broad view of the

present situation, spoke with such fafor of the new lamp that we cannot but believe that the central station must find it valuable. This conclusion is further warranted by the experiences of a number of companies from various parts of the country as brought out in the several discussions at the same meeting.

In the earliest conception the central station and incandescent lamp industries were most intimately connected. The first commercial methods of generating electrical energy, of subsequently distributing such energy, and of ultimately transforming it into light, were perfected by Thos. Edison some thirty years ago. After years of patient effort he succeeded in making an electric incandescent lamp which was of low efficiency and which had a life of but a few hundred hours.

In the incandescent lamp, by means of which electrical energy is converted into light, greater improvements have been made than in any other single piece of apparatus which is used in the process of producing such light. Not only has the electrical efficiency of light production been increased about 500 per cent., through the incandescent lamp, over its first commercial form, but the life of the lamps to-day at 1.25 watts per candlepower is many times greater than the early lamps even at an efficiency as low as 6 watts per candle. As the lamp manufacturing processes became better understood, the efficiency at which it became possible to operate the carbon lamp, and still secure a commercial life, was gradually increased so that we had the successive steps from the very low efficiency of the early lamps up to an efficiency of 3.1 watts per candle power which for a good many years has been the highest standard efficiency for carbon lamps. Until but a few years ago the possibility of ever securing an incandescent lamp with an efficiency much higher than that of the standard 3.1 watts per candle power carbon type seemed rather remote, and it is no wonder that the relation between the electrical energy consumed and the quantity of light produced by this lamp should have been used as a convenient basis by some central stations upon which to establish their system of lighting rates. That such an important question should have involved the efficiency of the lamps by which the light was produced, appears rather unfortunate, when we consider that within only the last few years it has been made possible to produce a certain amount of light with practically one-third of the energy formerly required.

In central station work the fixed operating and investment expenses form such a large proportion of the total cost of operation that it is very essential to take such charges correctly into consideration in laying out a profitable and equitable system of rates. In some cases the fixed charges which were to cover the fixed expenses were calculated on the basis of a certain number of hours' use of the connected load, usually in the familiar "16 candle power 50 watt equivalent," and were then included in some way in a kilowatt hour rate and thus made dependent on the amount of energy consumed.

It thus happened that in some cases central stations were operating on a system of rates which did not appear well adapted to a change to a higher efficiency lamp. The reduction in the amount of energy required to produce a certain quantity of light by the perfection of new light sources, naturally disturbed those central stations whose rate systems were largely based on the use of carbon lamps, and were it not for the fact that the new lamps served to stimulate a desire for more light on the part of the consumers, and further that it has been possible to secure business with the tungsten lamp which would not have been available with a less efficient and less attractive source of light, the situation would have been far from pleasant for many central stations. The same general state of affairs existed in the gas industry at the time of the introduction of the Welsbach mantle. The gas companies at first looked with considerable disfavor upon the newcomer through fear that the straight meter rate so largely used in the sale of gas would result in a serious loss of revenue. Experience soon demonstrated, without a question of a doubt, that the advent of the high efficiency Welsbach lamp was a wonderful stimulant to the gas business, and that the creation of a new business department and the active work along the lines of heating and cooking devices which came with increased activity in the lighting end of the business, served to bring about a very prosperous condition. We may confidently expect a similar prosperity in the central station industry as a result of the increased interest and activity awakened by the tungsten lamp. Public interest is now aroused in the question of lights and lighting as never be-

fore. A consumer who can, when daylight fails, flood his residence or store with a clear white light, that even rivals in beauty the daylight which it has been called upon to replace, derives a certain sense of satisfaction from his electrical service that he had never before felt. He appreciates the fact that light is a very valuable thing, and that good light, and plenty of it, will accomplish wonders in making his home more inviting or his store more attractive.

The high efficiency of the tungsten lamp makes it possible to secure in all classes of service, whether residential or commercial, a degree of illumination which, a few years ago, would have been almost beyond question because of the excessive cost, and which could not have been rivaled in purity of color at any price.

The residential lighting field can be profitably invaded with tungstens if the campaign is properly carried out. As a general rule, people are usually willing to spend about so much for electrical service, and through a reduction in the cost of electric lighting by the use of more efficient lamps, electrical heating and cooking devices of all kinds are offered an excellent opening. The effect of such a residential campaign should eventually tend to cut from the peak of the station load curve and fill in the hollow which has so long troubled the central station men.

A residential consumer who installs tungsten lamps, thus reducing his maximum demand, and who, by the use of any of the very handy electrical devices, consumes practically the same number of kw. h. as before with a lighting load only, betters his individual load factor, and enables the central station to serve with a given kw. of installed capacity a larger connected load. Such results cannot be secured in a day, but must come with a gradual education of the consumer to the advantages of electrical service for other purposes than for lighting alone, and with such realization on the part of the consumer will come increased prosperity for the central station.

The effect of installing the tungsten lamps on commercial circuits has been proven to be very successful and has raised but little doubt as to effect on revenue. Commercial customers are usually willing to take considerably more light than they had previously been using as they realize that the advertising value of such illumination makes it well worth the cost. I am sure that many merchants obtain more benefit from the attractive appearance of their store and show windows than from almost any other form of advertising, and further, that a proper lighting installation can do more toward producing such a desired effect than any other one thing.

To see that the new lamps are installed in the best possible manner should be the aim of every progressive central station. It is not only unjust to the consumer, but it is poor policy on the part of the station to allow tungsten installations to be made without at least telling the consumer something as to the best manner of using the lamps.

We may touch very briefly on the general progress in the art of lamp manufacture. The carbon filament lamps of 3.1, 3.5 and 4 watts per candle have been improved gradually from their early forms by constant research and development work, and even within the last few years a great deal has been done in bringing all types and sizes to a uniform high quality by more rigid inspections, careful photometry, and close selection. The gem lamp, the first step toward high efficiency, with a cellulose filament, metallized by the heat of the electric furnace, made it possible to burn them at an efficiency of 2.5 watts per candle with a life comparable to that of the carbon lamp at 3.1. A little later the tantalum lamp, with a metallic filament, was produced and was able to give a good commercial life at 2.00 watts per candle. This lamp did not receive the attention from the general public that it might have because the announcement of a lamp of even still higher efficiency was made before the tantalum lamp had been really commercially introduced.

The tungsten lamp is the result of years of research in the realm of new materials suitable for incandescent filaments. Great difficulties have been overcome, but the work will not stop, and the next year will witness a gradual improvement in the quality of the tungsten lamps, which to-day are giving such good results, just as the carbon filament lamps became better as experience was gained in the details of their production.

The tungsten lamp has been commercially developed for practically all classes of service, ordinary multiple, street series, sign lighting, train lighting, automobile lighting, miniatures for flash lights, surgical use, and for general decorative effects.

A 150 watt 120 candle power tungsten lamp has recently been added to the standard multiple line and fills the rather wide gap which previously existed between the 100 and 250 watt sizes. This lamp is placed on the market with the belief that it will, in many cases, prove very valuable in changing from gas to electric installations. The tungsten lamp for 200 volt service can soon be obtained in wattages of 45, 70, 110 and 180. These lamps should prove most valuable where 200 to 250 volt service is installed, as it will be the first high efficiency lamp produced for high voltage work.

The tungsten street series lamp can be obtained in candlepowers from 25 to 80 and in ampere ranges of 1.75, 3.5, 4.0, 5.5, 6.6 and 7.5, which meet the requirements of most practical work. The lamps can be operated in series with either incandescents or arcs, provided that the current of the circuit can be maintained at the value for which lamps were ordered. The tungsten street series lamp has several advantages over any other type of illuminant for the majority of streets. They can be installed on either the curb line or over the center of the street. They can be obtained in such candlepowers as will permit the most desirable spacing, and they can consequently be placed low enough to miss the obstruction of dense foliage, which often interferes with and in many cases altogether destroys the illuminating value of an arc lamp hung high over street intersections.

The tungsten street series lamp possesses advantages over gas for street lighting, in that it is capable of more varied and artistic arrangement; that is has a smaller depreciation in candlepower from the initial value; that the constancy and quality of the light is better and in the ease with which it can be controlled from some central point.

The tungsten street series lamp is rugged. Its comparatively heavy filament suffers but very little chance of mechanical breakage. It is capable of showing considerable economy over the carbon or gem types now in use, and from reports of many installations there is no question as to its merit in this respect. The tungsten street series lamp is well worth investigating, as increased candlepower in tungsten street lighting units for the same amount of money that the older types brought, appeals strongly to a city council and has a good effect on the general public, as far as its attitude toward the central station is concerned.

The central station man may feel absolutely confident in offering the tungsten lamp freely and without hesitation to his consumers that he is placing at their service the best means of converting electrical energy into useful light, and that a broad policy together with an interest in seeing that the lamps are installed in the best manner, cannot but in the end prove to be of the greatest benefit, not only to the consumers but to himself as well. The relations between the central station, the lamp manufacturer, and the consumer are very close. The central station supplies the energy for producing light; the lamp manufacturer supplies the means by which the transformation is accomplished. Only by co-operation between the two can the industries which they represent reach the fullest and broadest development.

CENTRAL STATIONS FOR TOWNS OF 1,000 POPULATION.

By Caryl D. Haskins, Manager of Lighting Department General Electric Company, Schenectady, N. Y.

WHEN the electrical industry was comparatively young, the greatest interest was displayed in the establishment of new plants to supply electricity for illuminating purposes, and the activity along these lines was so great at that time that installations were made in almost all communities of sufficient size to warrant the outlay.

Since that time, the electrical art has progressed with almost marvelous rapidity, and communities in which plants were established, many of which were at that time comparatively small, have also grown from the rank of towns to that of cities.

The result has been that gigantic installations which have grown up in the last few years have monopolized the greater portion of the talent and the time of those men who have made a specialty of electrical development; and the installation of new plants in

comparatively small or medium size communities has not received the attention from the engineering fraternity that it did in the past.

During this period a new generation has grown up, and to-day there are a vast number of communities in the country which are of sufficient size to support an electrical lighting plant, and which are in a position to demand the best that the world has to offer in the line of artificial illumination.

While it is true that the interest of our greatest electrical men has been diverted from channels of new development to the problems incident to larger installations, the interest through the country at large has been greatly increased. This is evidenced each day by the large number of inquiries which are received, asking for information as to the cost of installations and operations of electrical plants for towns ranging in population upwards from 500 people.

It is the purpose of this article to answer some of these general questions and to provide preliminary facts and figures on the costs of such installations.

Owing to the marked increase in efficiency, sturdiness and simplicity in the design of electrical apparatus, together with an even more marked decrease in first cost, towns which ten years ago could not have supported electrical plants, may now advantageously consider installations.

In making an estimate of the costs and apparatus necessary to install an electric power plant in a town of 1,000 people, there are many factors which must be predetermined in order to obtain figures which will exactly apply to any set of local conditions.

The best that can be done in making up a general proposition is to presuppose certain factors, derived from averages in a large number of particular cases. In making such general figures applicable to any one definite locality, the greatest care should be exercised in determining the exact value of these factors under such local conditions.

Probably the two most important items for determination are: The length of service which the plant shall supply, and the kind of fuel which will give the cheapest and most satisfactory results. It has, therefore, been thought expedient to make our general figures on plants operating for both power and lighting; that is, 24 hours a day; for plants doing a lighting business alone, running from sundown to morning, with possibly certain morning hours of service in the winter, the average operation being about six hours a day, and for each of these plants two types of fuel have been considered, coal and natural gas.

The uses of electricity are increasing so rapidly at the present time that almost every day brings to light some new application, and for this reason every new company should carefully consider the possibilities of service for power purposes; and if this cannot be profitably carried on under the present condition, provision should be made for maintaining a 24-hour service sometime in the very near future.

It is perfectly obvious that power business can be taken on at much lower rates than ordinary commercial lighting business, as the hours of service are much longer and the peak load very much less pronounced. Moreover the same machinery which is used in a strictly lighting plant only six hours a day may be operated 24 hours; thus getting four times the amount of work from the same invested capital.

Before proceeding with the detail estimates it might be well to state that the freight item, on account of its large variation, has not been included, and it has also been assumed that water may be obtained without cost. Further, it has been necessary to make arbitrary assumptions, based on average conditions, on the cost of fuel, poles, land, etc. The figures are throughout conservative and in all cases a ten per cent. item has been added to cover extras.

24-HOUR PLANT.

While it is by no means a common condition, there are many towns of 1,000 to 1,200 people, which have industries of sufficient size to support 24-hour service, and if in such a locality the connected load of 80 horsepower can be obtained in motors, it will most certainly pay to install a plant for this service.

In making an estimate the first problem that presents itself is the determination of the capacity of the plant. This is done in the following manner:

The connected lighting load for a plant operating 24 hours a day in a town of 1,000 or 1,200, usually consists of about:

1,500—16 c. p. multiple incandescent lamps, equal to 60 kw.	80.5 h. p.
60—60 watt series incandescent lamps equal to 3.60 kw.	4.83 h. p.
5—arc lamps equal to 2.5 kw.	3.85 h. p.

In addition to this, we should expect a connected load of not less than 80 horsepower in motors.

1. The day or motor load will slightly overlap the night load; this must therefore be considered in figuring size of installation.

Fifty per cent. of the total number of incandescent lamps installed in the houses or buildings is a conservative estimate of the number of lamps which will be lighted at any one time. The street lamps will be lighted from darkness to daylight, therefore, the total load on the station would not exceed 50 per cent. of the connected incandescent load (60 kw.) or 30 kw. plus 6.1 kw. (8.18 h. p.) the arc load necessary for street lighting, or 36.1 kw. (48.4 h. p.) which figures do not include line loss.

A plant of 100 kw. (134 h. p.) capacity will be of ample size to furnish this amount of energy, including all loss incident to the transmission, for the peak caused by the overlapping of day and night loads and allows for spare apparatus to cover emergency conditions.

The total cost of a building for such an installation, including the foundation and real estate, should not be more than $1,650.

LIST OF APPARATUS IN GENERATING STATION.

Boiler Room—	
2—70 h.p. return tube boilers at $725	$ 1,450.00
Masonry	550.00
Piping, inc. connection to engine	250.00
Foundation for heater and pump	25.00
Haulage	75.00
1—Steel stack, 100 h. p.	135.00
1—Feed water heater, 100 h. p.	150.00
1—Boiler feed pump, 100 h.p.	110.00
Total	$ 2,775.00
Engine Room—	
2—75 h. p. high speed simple engines, $1,050 each	$ 2,100.00
Foundations, each $100	200.00
Installation, each $100	200.00
2—50 kw. (67 h. p.) generators, $805 each	1,610.00
2—Belts, $50 each	100.00
Switchboard	500.00
2—2¼ kw. CQ exciters, $150 each	300.00
2—Belts, $10 each	20.00
1—C. C. transformer	220.00
1—2 kw. transformer for station lighting	30.00
Installation, wiring, foundation, etc	220.00
Total	$ 5,550.00
Franchise and legal expenses	350.00
Building, including real estate	1,650.00
Total cost of station	$10,275.00

These figures are conservative, and it is probable that by careful supervision the cost of the plant could be considerably reduced.

After generating the current at the station it is necessary to carry it to the consumers. The method of carrying it, or transmission as it is commonly called, depends upon the size of the town. If the station can be located in the most thickly populated portion, that is, at the center of distribution, and if 75 per cent. of the load is within 1,250 feet of the station, the current may be at low voltage; i e., 220 volts.

There are many advantages to this system in that it obviates the use of transformers and brings the current through the streets at the same pressure as is used in the houses.

On the other hand, unless the load is distributed as outlined above, the cost of a low voltage installation is out of all proportion to its advantages, and in this case it is expedient to use a pressure of 2,300 volts and transformers to reduce the voltage. The problem of distribution is one which must be solved for each individual case, and when making a definite estimate of the cost of a plant, it is recomended that a map of a town be furnished (or if this is not available, a sketch) showing the streets, the probable location of the power plant, and where the current will be used, and send it to the manufacturer. With this information they will gladly give a recommendation which will exactly meet the requirements.

The cost of a typical distribution using 2,300 volt, three-phase with transformers is:

10—5 kw. (6.7 h. p.) pole H. B. type transformers	$ 500.00
5—2 kw. (2.68 h. p.) pole H. B. type transformers	145.00
4—1 kw. (1.34 h. p.) pole H. B. type transformers	76.00
*9—Miles of No. 6 wire, weight 3,600 lbs.; poles, inc. cross arms, insu-	

lators, pins, etc.; line construction; 5—arc lamps, at $25	1,550.00	
60—Series incandescent lamps, at $7	420.00	
90—Recording wattmeters, at $12	1,080.00	
Total		$ 3,771.00
Total central station cost		10,275.00
Total first cost of entire installation		$14,046.00
10 per cent. for extras		1,417.00
Grand total		$15,463.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

Operating Expenses—

Fixed charge, including depreciation, insurance, and taxes, 10 per cent	$1,558.80
Engineers' salaries (2 men; one at $720, one at $600)	1,320.00
Superintendent's salary	900.00
Coal, 700 tons, at $2.75 per ton	1,925.00
Oil, waste, etc.	100.00
Incidentals (supplies)	200.00
Office expenses	250.00
Total operating expenses	$6,253.80
Income—	
Arc lamps, $70 each	$ 350.00
Series incandescent	1,350.00
Power (a conservative estimate)	2,800.00
Commercial lighting	3,450.00
Total	$7,950.00
Total operating expenses	6,253.80
Profits to be divided among stockholders or set aside for sinking fund	$1,696.20

Equals 10.89 per cent. on money invested.

When operating 24 hours per day at an average load of 14.7 kw. (19.7 h. p.) per hour, the output of the plant will be 35.2 kw.-hr. (472 h. p.-hr.) per day, or a total of 128,500 kw.-hr. (172,000 h.p.-hr.). This figure divided into $6,253, the total operating expenses for the year, shows a cost of approximately 4.85 c. per kilowatt-hour for the power generated.

The revenue from the various classes of service and the proportion of the total kw.-hr. output represented by each may be enumerated as follows:

Street Lighting (All Night Service)—

The load represented by this class of service, including 15 per cent. for loss in transmission is 25,530 kw.-hr. or approximately 20 per cent. of the total output.

Power—

We have previously assumed a power load 59.6 kw. (80 h. p.). If 700 kw.-hr. per year equals the consumption per connected h. p., the total load from this class of service would be 56,000 kilowatt-hours. At 5 c. per kw.-hr. this service would yield an income of $2,800. The total load represented plus 25 per cent. for loss is approximately 70,000 kilowatt-hours, or 55 per cent. of the total output.

Commercial Lighting Load—

As has been already stated, the total connected commercial lighting load in this plant will be approximately 60 kw.; 50 per cent. of this load, or 30 kw. will be the peak load taken by the commercial lighting service at any one time, and 17½ per cent. of this peak load may be considered average load which will be demanded during a period of 12 hours. On this basis we have a consumption of 23,000 kilowatt-hours per year paid for at the rate of 15 cents per kilowatt-hour.

Assuming that but 70 per cent. of the generated power is delivered and paid for, the station output for this class of service will be 33,000 kilowatt-hours per year, which amount allows the large item of 10,000 kw.-hr. for line, transformer, and meter losses and for bad debts.

Gas Engine Plant—

For localities where natural gas can easily and cheaply be obtained, in which the price of coal is so high that gas presents itself as a more attractive fuel from a financial standpoint, we would recommend an installation using gas engines. The size of the equipment will be estimated in the same manner as it was for the steam plant. The connected load will also be the same.

A plant of 100 kw. capacity would be of ample size to furnish this amount of energy.

The total cost of a building including the foundation and real estate should not be more than $1,200.

LIST OF APPARATUS IN GENERATING STATION.

2—75 h. p. gas engines, complete with 50 kw. generators	$ 8,000.00
Foundations, each $100	400.00

Installation, each $150.....	300.00
2—3¼ kw. CQ exciters, each $150	300.00
2—Belts, each $10.....	20.00
Switchboard	500.00
1—Constant Current transformer	200.00
1—2 kw. transformer for station lighting.....	30.00
Installation, wiring, foundations, etc.....	220.00
Total .....$	9,990.00
Building, including real estate	1,200.00
Line material, same as in steam plant.....	3,896.00
Legal expense.....	350.00
Total .....$	15,436.00
10 per cent. additional.....	1,543.00
Grand total.....$	16,979.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

Operating Expenses—

Fixed charge, including depreciation, insurance, and taxes at 10 per cent.....$	1,697.00
Engineers' salaries (2 men; one at $720, one at $600....	1,320.00
Superintendent's salary.....	900.00
3,599,000 cu. ft. of gas at 30 c. 1,000 cu. ft.....	1,080.00
Oil, waste, etc.....	200.00
Incidentals	400.00
Office expenses.....	250.00
Total operating expenses..$	5,847.00

Income—

Revenue, same as from steam plant .....$	7,950.00
Total operating expenses.....	5,847.00
Profits to be divided among stockholders .....$	2,103.00

This equals approximately 12.4 per cent. on the money invested.

This is based on the assumption that gas is available at 30c. per thousand cubic feet, and that the fuel consumption will not exceed 28 cu. ft. per kw.-hr. While this consumption may very probably be materially bettered it is in line with the conservative assumptions made on fuel consumption of steam engines.

PLANT FOR LIGHTING ALONE.

In communities where there is no present possibility of developing a day load and where it does not seem expedient to run a plant continuously, it will be necessary to figure on the correct installation for a plant running from sundown until, let us say, 1:00 a. m., but consideration must be given to the fact that within a few years 24 hours service will be demanded.

The size of the equipment for such a plant is arrived at in exactly the same way as in the case of the 24-hour installation, except that in this case there will be no day load, and we cannot expect to have quite as large commercial incandescent load.

The connected lighting load for a plant operating 6 hours a day in a town of this size usually consists of:

1,200—16 c. p. multiple incandescent lamps, equal to 48. kw. 64.4	h. p.
60—60 watt series incandescent lamps, equal to 3.6 kw. 4.83	h. p.
5—arc lamps, 2.5 kw..... 3.35	h. p.

As has been stated, fifty per cent. of the total number of incandescent lamps installed in the houses or buildings is a conservative estimate of the number of lamps which will be lighted at any one time. The street lamps will be lighted from darkness to midnight, therefore, the total load on the station will not exceed 50 per cent. of the connected incandescent load, 48 kw., or 24 kw., plus 6.1 kw. the arc load necessary for street lighting, or 30.1 kw.; this does not include 10 per cent. for line loss.

A plant of 50 kw. (67 h.p.) capacity would be of ample size to furnish this amount of energy.

The total cost of the building, including the foundation and real estate, should not be more than $1,250.

LIST OF APPARATUS IN GENERATING STATION.

Boiler Room—

1—70 h.p. return tubular boiler at $725...	$725.00	
Masonry	300.00	
Piping, including connection to engine...	200.00	
Foundations for heater and pump.....	25.00	
Haulage	40.00	
1—Steel stack, 100 h.p.	135.00	
1—Feed water heater, 100 h.p.	125.00	
1—Boiler feed pump, 100 h.p.	75.00	
1—Injector, $15 each.	15.00	
Total		$1,640.00

Engine Room—

1—75 h.p. high speed simple engine.....$	1,050.00
Foundations	50.00
Installations	95.00
1—50 kw. (67 h.p.)	

generator	805.00	
2—Belts	55.00	
1—3½ kw. CQ exciter	180.00	
Switchboard	200.00	
1—Constant current transformer for station lighting	40.00	
1—Constant current transformer	270.00	
Installation, wiring, foundation, etc.	150.00	
Total		2,895.00
Building, including real estate		1,250.00
Franchise and legal expenses		350.00
Total central station cost		$6,135.00

These figures are conservative, and it is probable that, by careful supervision, the cost of the plant could be considerably reduced.

The method of distribution and the cost of the material required for that purpose will be practically the same as that given for the 24-hour day plant in the first part of this article.

Total cost line material	$3,570.00
Total central station cost	6,135.00
Total first cost of entire installation	$9,705.00
10 per cent. extras	970.00
Grand total	$10,675.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

Operating Expenses—		
Fixed charge, including depreciation, insurance, and taxes at 10 per cent	$1,067.00	
Engineer's salary	720.00	
Coal, 350 tons at $2.75 per ton	962.50	
Oil, waste, etc.	75.00	
Incidentals	125.00	
Office expenses	200.00	
Total operating expenses	$3,149.50	
Arc lamps, $65 each	$325.00	
Series incandescent lamps, $18	1,080.00	
Com. lighting	3,080.00	
Total		$4,485.00
Total operating expenses		3,149.50
Profits to be divided among stockholders		$1,335.50

This equals approximately 12.8 per cent. on money invested.

When operating six hours per day at an average load of 17.5 kw. per hour, the output of the plant will be 115 kw.-hr., or a total of 42,200 kw.-hr. Dividing $3,149, the total operating expenses for the year, by this figure, we have a cost of approximately 7.5 c. per kilowatt hour for the power generated.

The revenue from the various classes of service and the proportion of the total kilowatt-hour output represented by each may be enumerated as follows:

Street Lighting (Midnight Service)—

The load represented by this class of service, including 10 per cent. for loss in transmission, is 16,600 kilowatt-hours, or approximately 39 per cent. of the total output.

Commercial Lighting Load—

As has been stated, the total connected lighting load in this installation will be 48 kw., and 50 per cent. of this load, or 24 kw., will be the peak demanded by this class of service. The average load required during the period of service, i. e., until 1 A. M., will be approximately 35 per cent. of this peak, or 8.6 kw., which amount will mean an annual consumption of 20,500 kw.-hr. paid for at 15 c. a kw.-hr.

Not more than 80 per cent. of the generated power will be delivered and paid for. The plant must therefore generate 25,600 kw.-hr. per year, which allows 5,100 kw.-hr. for line, transmission and meter losses and bad debts.

GAS ENGINE PLANT.

As in the 24-hour plant, natural gas, if it can be obtained at low rates, makes a very attractive proposition. A plant of 50 kw. (67 h.p.) capacity would be of ample size.

The total cost of such a building, including the foundation and real estate, should not be more than $1,000.

LIST OF APPARATUS IN GENERATING STATION.

1—75 h.p. gas engine, complete with 50 kw. generator	$4,000.00
Foundations	200.00
Installations	150.00
1—3½ kw. CQ exciter	150.00
1—Belt	10.00
Switchboard	200.00
1—Constant current transformer	220.00
1—2 kw. transformer for station lighting	30.00
Installation, wiring, foundation, etc.	160.00
Total	$5,120.00

Legal expenses	350.00
Building, including real estate	1,000.00
Line material, same as in steam plant	3,896.00
Total	$10,366.00
10 per cent. additional	1,036.00
Grand total	$11,402.00

OPERATING EXPENSE AND INCOME BALANCE SHEET.

Operating Expense—	
Fixed charge, including depreciation insurance, and taxes at 10 per cent	$1,140.00
Engineer's salary	120.00
1,200,000 feet of gas at 30 c.	360.00
Oil, waste, etc.	125.00
Incidentals	225.00
Office expenses	200.00
Total operating expenses	$2,770.00
Income—	
Revenue same as from steam plant	$4,405.00
Total operating expenses	2,770.00
Profits to be divided among stockholders	1,635.00

Equals approximately 14.5 per cent. on money invested.

This is based on the assumption that gas is available at 30 c. per thousand cubic feet, and that the fuel consumption will not exceed 28 cu. ft. per kw.-hr.

MUNICIPAL OWNERSHIP.*

By J. W. Dappert, City Engineer, Taylorville, Ill.

MUNICIPAL ownership, as usually applied, is ownership by a city or other corporate government of some one or more public utilities, which from some inherent quality inevitably tend to become monopolies. In a broader sense, the term might be applied to a city owning and operating any or all kinds of business. In these remarks the term is used in the more restricted sense to apply to heating, lighting, furnishing water to the municipality, operating street railways, and like enterprises.

It is believed that the trend of public sentiment is growing more and more in favor of municipally owned and operated plants, and especially is this so in the United States. The reason for the growth of sentiment favorable to municipal ownership is largely due to decreased cost of service given. A few examples are as follows:

In Massachusetts, in 1904, 51 private companies supplied water to a population of 211,467, while 129 municipal plants supplied 2,378,570 people. All cities of the State own their water works, and all but three of the larger towns either own them or are arranging to do so.

In the entire United States the only cities of over 110,000 population which rely upon private water works are San Francisco, Cal., Denver, Colo., and Indianapolis, Ind., leaving 36 of our largest cities supplied by municipal plants. Of 33 cities in the United States having a population of over 60,000 and under 110,000, but 10 rely upon private water works. Of the smaller cities in the United States having a population of less than 60,000, considerably more than half of them own their own water works; 766 cities and towns of more than 3,000 population own their own water works plants, as compared with 661 places served with private companies.

On November 12, 1909, the sentiment of the citizens of San Francisco, Cal., was favorable to municipal ownership of water works, as shown by a vote of 6 to 1. An elaborate system of water works is now being planned. New York City owns its docks, Boston its ferries, and Chicago by a popular vote in 1902 adopted municipal ownership of street railways, gas and electric railway plants, which has not yet come to pass fully, but it has for many years owned and operated its water works, with 2,000 miles of main supply pipes.

Municipal ownership of electric light plants has grown rapidly in recent years. In the past 25 years the municipally owned light plants in the United States have increased from 1 to 1,050; private plants have increased from 7 to 3,234; 13 light plants have been changed from municipally owned to private ownership, and 170 changed from private to municipal ownership. Canada has 80 municipally owned light plants, while in England over two-thirds are municipally owned.

In Wisconsin the municipally owned light plants have increased from 3 1/3 per cent. to 38 per cent. in 17 years. In 11 Wisconsin cities the light plants and water works are operated together.

Nashville, Tenn., built its own light

*A paper before the Illinois Society of Engineers and Surveyors.

plant in 1902, and in one year furnished more than double the light previously supplied by the company at a cost of $15,770 less, while the old company furnished commercial lighting at one-third of the previous rate.

*Public gas plants are owned by Richmond, Va., Wheeling, W. Va., and Duluth, Wis. Very many smaller municipalities own one or more of the public utilities. Many of the state legislatures during recent years have passed laws authorizing municipalities to purchase and erect water works and lighting plants, and authorizing extra taxation or bond issues to accomplish the same. There has also been a growing tendency upon the part of the municipalities to limit the franchises which they grant to corporations, with the idea of making municipal ownership possible in the near future.

In the old world, notable instances of successfully managed municipal plants are the street railways of Glasgow, Scotland; Plymouth, Blackpool, Liverpool, Sheffield, Hull and Southampton, England, and Belfast, Ireland.

Hull, England, is a notable example of benefits accruing from municipal ownership. Up to 1899 no improvements had been made by the city. The streets were narrow and badly paved, and transportation poor. After adopting the idea of municipal ownership, the city broadened and paved the streets, acquired the street car lines, modernized them and placed them on a paying basis. The city also acquired and improved the docks, built fountains and beautified its public grounds. The result has been a rapid increase in population and greatly improved business. It now has 12 miles of double-track street railways, which is being added to, and charges 2 cents a trip. The financial returns are $122,000 annually after providing for interest and sinking funds.

Liverpool, England, has acquired municipal ownership of its street railways, and, in spite of reducing the fare to 2 cents, has increased its mileage, advanced the wages of its employes, increased the length of ride for a single fare threefold, increased the average speed from 5½ to 8 miles per hour, kept its property in good repair, paid all operating expenses out of revenues derived, set aside a sinking fund of $2,846,186, contributed to the reduction of taxes by paying $490,860 into the city treasury, and reduced its capital obligation $539,460.

London, England, is an example of the extreme exploitation of the city by corporations. It has 31 companies and local administrations supplying electricity, 8 water companies, and a large number of different corporations operating surface and underground railways. The public service is mostly very poor, and there is more local travel by means of bus and cab than upon the street cars. It also is said to have the worst managed port in the world, operated privately or by a corporation. It is noteworthy that the municipal government of London in 1905 built and is operating 6 passenger steamboats upon the river Thames, and that steps were taken by the general government to acquire all the telephone systems of England by the year 1911.

In the British possessions of North America many, and indeed most, of the larger cities own their public utilities. Winnipeg, population 145,000, owns its own water supply, water-softening plant, garbage crematory, and was upon the point of establishing its own lighting system when the local company reduced rates greatly, thus postponing the time when the city will install its own lighting service. It also does its own work of sewer construction, laying water mains, paving, street repairs, and making all other improvements by day labor.

In Germany most of the public utilities are under the management of either the central government or local municipal governments. Consul T. H. Norton reports that 58 cities with a population each of 50,000 or more own and conduct some or all of their public utilities, including water works, gas works, electric light and power plants, street railways, public bath houses, market halls, garbage removal plants, etc. Also 22 cities of the class named provide tenement houses at low rates for municipal laborers and employes. Of the 44 cities named owning gas works, the net annual profits upon this item alone are $10,000,000. Of this sum $2,500,000 is required for interest, and of the balance more than half goes toward a reduction in taxes.

Vienna, Austria, besides owning its own tramways, electric lighting system, gas works, etc., also owns grain elevator, central cattle market, restaurants, breweries, five savings banks, life insurance, funeral and undertaking establishments, and is about to purchase its own coal mines.

Multiplied instances could be given of cities owning some one or more public utilities and being well satisfied with the results. It is also true that there are many instances in which municipal ownership has not proven to be all which was expected

of it. It is, however, probable that the cities and municipalities of the United States are adopting more and more, each year, the idea of municipal ownership of public utilities, and, if so, what is the reason for it?

Answer: greed of the public utility corporations. If the public service corporations would be satisfied with a reasonable profit, with small dividends upon actual and not watered stocks, and if they would recognize the fact that the people which they serve have rights, as well as themselves, their lease of life might be increased. Publicity, it seems, would be the one thing which is needed to act as a sort of equalizing influence, to keep the municipalities from being exploited beyond reasonable measure, and yet allow the corporations to make a reasonable profit upon their investments. In cases where conditions become unbearable, and usually not until then, the municipalities adopt municipal ownership.

NEW BRITISH SEWAGE DISPOSAL WORKS.

By a Special Correspondent.

SHEFFIELD has opened the first section of her extended reconstructed sewage works. Established three miles from the center of the city, the scheme marks the first stage in the work of substituting the bacteriological process of sewage purification for that of lime precipitation, followed by aeration over weirs and continuous filtration through coke. The latter system, which was considered very satisfactory at the time the works were opened, is regarded as insufficient by the Local Government Board and the Yorkshire Rivers Boards, their attitude being that it is solely a process of clarification, which has no effect on the dissolved impurities in the sewage, and therefore cannot prevent subsequent decomposition of the effluent after discharge into the river. Experiments in the bacteriological treatment have been made by the corporation for ten years past, and it was ultimately decided to adopt a scheme for purification by this process, consisting of continuous-flow settling tanks and contact beds.

The work, which includes the remodeling of the present system, comprises the following: New outfall sewer and main valve chamber; two new catchpits and alterations to the two existing catchpits; nine new settling tanks and conversion of the existing tank area into eight additional tanks; deepening the two existing sludge wells and remodeling the pumping plant; 60 half-acre contact beds; 16 acres of storm beds; bridge and siphons across the river Don, roads, railways, etc. The estimated cost of the work is $1,351,845, exclusive of land and second contact beds. The gross area of the land which will ultimately be available is 204 acres, and the approximate cost $430,000.

The works will be capable of dealing with a maximum rate of flow of 64½ million gallons in 24 hours, this quantity being determined chiefly by the fact that the Local Government Board require provision for treating in periods of storm about six times the dry-weather flow. The scheme is based on a dry-weather flow, including trade wastes, of 12 million gallons a day. The filling material of the contact beds is screened clinker, graded from coarse to medium, and fine on the top, and the average depth is 4 ft., the floors being graded to the outlets.

After leaving the settling tanks, the sewage will pass along the main conduit and branches to a feed culvert communicating with a circular distributing chamber in the center of each bed, whence it will be distributed over the surface by means of channels formed in the surface of the filling. The works now opened consist of the altered catchpits and sludge wells, six new settling tanks, and twelve contact beds, and will treat a maximum flow of six million gallons a day. This quantity will be rapidly increased to twelve millions as twelve other contact beds, the construction of which is completed, are filled with clinker.

When the entire scheme is completed it will represent 460,000 cubic yards of excavation, 57,000 cubic yards of concrete, 29,000 cubic yards of brickwork, 180,000 tons of clinker, 80 acres of 3-in. concrete floors, 40 miles of drainage tiles, 3½ miles of conduits and subconduits 5 ft. wide and over, and 2 miles of culverts 2 ft. to 5 ft. wide.

Another great sewage scheme that will soon be in operation here is that of the Cardiff Corporation in South Wales. The new main outfall sewer is under construction, and the necessity for this new scheme has arisen solely from the inability of the present sys-

tem to cope with storm water. The existing outfall basin is small, and the outfall is tide-locked for about five hours during every tide. The district is low, and the object of the present scheme is to remedy the difficulties created by the low level and to obtain a free discharge of sewage and storm water at all states of the tide. The invert level at the termination of the sewer, therefore, was fixed at 20 ft. above ordnance datum, which is about the same as high water of mean spring tides, with an outfall conduit leading therefrom and terminating at low water mark of mean spring tides. This, of course, necessitated pumping as one of the main features of the scheme. The present main sewer will be intercepted at three points, whence the new intercepting sewers—two of which will be barrel-shaped, 4 ft. in diameter, and the third egg-shaped, 3 ft. 9 in. by 2 ft. 6 in.—will converge to a junction in Penarth Road. From the last-named point a 6-ft. circular sewer will convey both the dry-weather flow and the storm water along Penarth Road for a distance of 1,500 yards at a gradient of 1 in 1,650 to the pumping station. The whole of the sewage up to a maximum rate of pumping equivalent to 150 gallons per head per day of the population will be pumped to a height of 56.5 ft. above ordnance datum, or a total lift of 61.5 ft., whence it will gravitate to the outfall. The storm water over and above this quantity will discharge into the river Ely, which is a tidal river. Discharge will be free until mean tide level is reached, after which pumping will be resorted to, the maximum head of tide to be pumped against being 32 ft.

The screening chamber consists of two compartments fitted with penstocks on both the inlet and outlet ends, so that one may be made accessible for cleaning or repairs while the other is in use. Immediately beyond the screening chamber a weir has been constructed for the purpose of forming a storm water overflow. The normal flow of sewage will thus be diverted to the pump-well for delivery through the rising-mains to the outfall at Lavernock, while storm water will flow over the weir through the conduits for a distance of 130 yards into the river Ely. The overflow conduit consists of 4-ft. cast iron pipes.

The pumping station buildings consist of an engine room, 75 ft. by 41 ft.; gas engine room, 25 ft. by 41 ft.; boiler house, 64 ft. by 50 ft.; pump chamber, 73 ft. by 40 ft.; workshop, 20 ft. by 18 ft.; and office, mess room, stores, etc. The pumping plant comprises vertical plunger pumps driven by steam engines for dealing with the ordinary sewage, and centrifugal pumps driven by gas engines for the storm water. The steam-driven plant comprises four sets of compound, condensing, vertical steam engines, each of about 60 i.h.p., and capable of pumping continuously at the rate of 150,000 gallons an hour, and two smaller sets, each of about 20 i.h.p., capable of pumping 50,000 gallons an hour. The storm water plant comprises two sets of centrifugal pumps direct coupled to vertical gas engines, each of about 150 b.h.p., and capable of discharging 680,000 gallons an hour against the head caused by the highest tides.

From the head of the gravitation sewer to its termination at Lavernock is a distance of 4.4 miles, the last 1 1/2 mile of which consists of a reservoir sewer 13 ft. in diameter. The trunk sewer, which is 4 ft. 9 in. in diameter, and is laid at a gradient of 1 in 1,950, extends from the top of the rising-mains to the beginning of the reservoir sewer, a distance of about 3.3 miles. The greatest depth below the surface of the ground to the invert is 172 ft., while for 80 yards the sewer is carried above ground on a concrete wall.

With the exception of a length of about 450 yards, the whole of the work has been carried out in tunnel at depths varying between 16 ft. and 172 ft. below the surface. The reservoir sewer is 1.08 mile in length and of horseshoe section. It has been carried wholly in tunnel at depths from 22 ft. to 122 ft. to invert below the surface. The penstock and overflow chamber forming its termination are built near the face of the cliff at Lavernock Point. The chamber is constructed of brickwork, built in cement mortar, and roofed over with a semi-circular arch 14 ft. 6 in. in span. A masonry weir is carried up to a height of 17 ft. above the invert level, thus impounding not less than 4½ million gallons; above this height overflow will take place in case the sewer should become surcharged during the hours between the period sanctioned for ordinary discharge. The outfall conduit from the penstock chamber across the foreshore to low water of spring tides is 546 yards in length, of which 41 yards is in tunnel through the cliff. The conduit consists of 36-in. cast-iron pipes, with turned and bored joints, embedded in cement concrete in a trench through the rock.

EDITORIAL COMMENT

Municipal Electric Lighting in Boston

The Illinois Bill for Commission Government

MUNICIPAL ELECTRIC LIGHTING IN BOSTON.

The city of Boston under the later administrations seems to have been unwilling to avail itself of the services of the state Board of Gas and Electric Light Commissioners and to have been willing to pay a rate for arc street lighting which is materially higher than that paid by most large cities.

In 1907 the state board held hearings on a petition of the Public Franchise League of Boston and recommended reductions in the maximum commercial lighting rates from 15 to 12 cents per kilowatt hour, but the inquiry did not extend to the price of street lights, as that subject was at the time under discussion between the city and the company directly. The rate prior to that time was 34 cents per lamp per night, or $124.10 per year.

The state board in its investigation went into the question of the cost of furnishing light by the company, including the reasonable return on a reasonable valuation of the plant, but not very exhaustively, and definitely excepted the street lighting plant, with the statement that this could be done because the street lighting system was operated independently of the other business of the company, so far as the operation and maintenance charges are concerned. The board has full authority to make these investigations, much more than the city has.

The company made its charges for commercial lights on a rather complicated maximum demand system of rates and discounts whereby the primary and secondary rates are 20 and 5, 15 and 12, 15 and 9, and other rates are 13, and 15, 6, 5, 3, 2½, varying according to kind and amount of service. There are also discounts which, for some large consumers, may be as much as 50 per cent on part of the bill. The rates for lighting city buildings were the same as for other customers, but the discounts begin at a smaller bill for the month.

The state board recommended the reduction of the commercial rate to a flat rate of 12 cents and that if a customer preferred the present system of charges his bill should be so modified that he would never pay more than 12 cents. The board also condemned the special rates given a few customers, including the city, and recommended their discontinuance. The net result to the city was, therefore, an increase in rates.

The result of the discussion of arc street light rates between the city and company was a five-year contract at $103.54 per lamp per year.

At the last meeting of the old council, held February 3, a report was presented claiming that the city's rates are exorbitant, and giving some figures to demonstrate it. As compared with the Boston price, Baltimore paid $67.49, Washington $85, Cincinnati $72, New Orleans $85, Pittsburg $90, all served by conduits, while Baltimore, which owns the conduits, pays $57 for lights on the conduit lines. Hartford pays $60 for overhead wire service and $64 for conduit service. St. Louis has a contract for $50 a lamp, the beginning of which has been anticipated by the company.

The street lighting plant of the Boston company being so nearly independent of the other business of the company, it would seem to be easy, at least through the state board, to determine the fair price for arc lights if the city authorities so desired. The new city administration may be able to take the matter up even if there is a long term contract now in force.

In the same way the report shows the

excessive rates for lighting city buildings, the rates being 3½ cents per kilowatt hour in San Francisco, Chicago and Providence, 3¾ cents in St. Louis, and 6 cents in Washington, New Orleans, Indianapolis and Baltimore, as compared with about 10 cents in Boston. The San Francisco company receives an average price from all its business of 4¼ cents a kilowatt hour and the report states that the Boston company receives about 7 cents. However, before the hearing in 1907 and the proposed 20 per cent reduction in the maximum demand rate and the elimination of special contracts and special discounts to certain customers, the average receipts from regular large users were 7.2 cents per kilowatt hour; for the small consumers, including three-fourths the total number, were 14.2 cents; for churches were 13 cents; for power were 5.6 cents; for elevators were 8.5 cents; for the city were 7.13 cents; and for those under special contracts were 3.61 cents per kilowatt hour.

It is evident that further readjustment is necessary, and the new administration can make one good record by taking the necessary steps toward that end.

THE ILLINOIS BILL FOR COMMISSION GOVERNMENT.

The Senate of the State of Illinois has just passed a bill providing for the adoption of a commission form of government by any city or village of less than 200,000 population so desiring, the provisions of which will be of interest although the bill must pass the House of Representatives before it becomes a law.

On petition of one-tenth the number of voters at the last election of mayor or president an election is held to decide whether the commission form of city government shall be adopted.

If it is adopted, a mayor and four councilmen are elected. They are nominated on petition of 25 voters for each candidate, and the candidates are voted for in a primary election, on the ballots for which the names of the candidates for mayor are arranged alphabetically and the names of the candidates for the four commissioners' places are arranged in another alphabetical list. The laws for registration of voters apply to the primary election.

The two receiving the highest numbers of votes for mayor and the eight receiving the highest numbers of votes for commissioner are the nominees to be voted for at the regular election, ballots containing the names in alphabetical arrangement, two in the list for mayor and eight, or less if there were not so many candidates at the primary, in the list for commissioners.

Three commissioners constitute a quorum and a majority. The mayor has a vote and has no veto, but every measure passed must be signed either by the mayor or by two commissioners. The commissioners as a whole have the power of the present city council and the administrative duties are distributed among the commissioners, one managing the department of public affairs, one accounts and finances, one public health and safety, one streets and public improvements, and one public property. The mayor takes the first department and the council at its first meeting assigns the other four. It also prescribes number and duties of employes. The council elects a list of city officials in which the city engineer is conspicuous by his absence, and also elects the heads of the principal departments subordinate to those of which they are individually the superintendents. Appointees are subject to such civil service regulations as are already in force.

Salaries run from $50 for mayor and $40 each for councilmen in towns of less than 2,000 population to $6,000 and $5,500 in cities of over 100,000 population at the national or state census next preceding their election. Other salaries are fixed by the council but cannot be changed during the six months preceding the regular biennial election.

Grants of franchises for public service utilities must be approved by a general or special election.

If a petition signed by twenty-five

per cent of the number of voters at the last election of mayor is filed after three months' incumbency, an election is held to vote for a successor to any elected officer whose displacement is desired, the primary election preceding as in the regular election.

Ordinances may be presented on petition of twenty-five per cent of the voters, and in such case the council shall pass them without change or call a special election. If the petition is signed by at least ten per cent of the voters, the ordinance must be passed or submitted at the next general election.

All ordinances except those concerning public peace, health or safety with emergency clause and passed by two-thirds vote (which would seem to be four votes) go into effect only after thirty days from date of final passage, and if ten per cent of the voters so petition during the thirty days the ordinance is suspended, and if not repealed by the council is submitted to popular vote.

Public service corporations must supply equal and uniform service to all without discrimination as to rate and no free service is permitted except transportation of firemen and policemen in uniform, unless authorized by ordinance. Both the public service corporation and the recipient of an unauthorized preference as to service or rate are subject to fine or imprisonment.

A city auditor is appointed by the judges of the circuit court, to serve at salary fixed by the council and under bond approved by mayor and commissioner of accounts and finances. He examines books of all officers, approves claims against city and countersigns warrants drawn on appropriations previously made.

After four years' trial a town or city may vote to return to its original form of government.

The Senate added a number of amendments regarding the regulation of corporations, limiting their franchises to twenty years; limiting issue of stocks and bonds to money, labor or property actually received at reasonable value; requiring payment to city of at least three per cent of gross revenues; providing for publicity of their accounts, and fixing methods of enforcing the law and penalties for violating it.

In general the proposed law seems to be applicable to the smaller cities and should be very satisfactory. A few doubtful points will be noted, but they are not fatal to the success of the law if administered by its friends or closely watched by them.

The auditor provided for may to a large extent take the place of the finance commission provided for Boston. The provisions above noted make it possible for a hostile council to harass the auditor without opportunity for redress.

Where all candidates for public office are so well known as they are in the smaller cities, the commission form as prescribed in this bill is not so open to the criticism that it perpetuates the indefinite distribution of responsibility, which is the great defect of the present form of government by mayor and council, nor to the other principal objection that the qualifications of the superintendents of the various departments for their duties are altogether a matter of luck, it being almost impossible to elect a certain man for a certain department.

Whether the bill includes cities of too large size for satisfactory application of its principles is a question to be answered only by trial. It is probable that the plan will work much better in cities of less than 25,000 population than in those that are larger. The superiority of the Boston form of commission government, which makes the council responsible for legislation and the mayor responsible for the administrative departments, at least for the larger cities whose business is extensive enough to require the larger number of employes, is discussed in the December number of MUNICIPAL ENGINEERING, vol. xxxvii, p. 393.

Even the friends of the Illinois bill are doubtful of its ability to get through the House of Representatives, but its passage would mark a notable advance in municipal conditions in that state.

THE QUESTION DEPARTMENT

Effect of Length and Irregular Profile on Suction Line of Pump.

We have a case where a 10-inch cast iron bell and spigot pipe 1884 ft. long has been laid from a river to an industrial plant, through which it was intended to draw water for manufacturing purposes. At the river end there is a 10-inch riser for the purpose of raising water about 3 ft., thence through a 90 degree elbow, afterward a 10-inch swinging check valve, then the pipe is laid horizontally for several feet, where it is intercepted by a street main and makes a dip about the diameter of the 10-inch pipe, then it gradually rises to a height of about 5 ft. above the surface of the water at a point 800 ft. from the river. In the next 200 ft. it drops about 4 ft. and makes also a right angle turn. Beyond this it runs about level and makes two right angle turns, and its end is connected to a duplex pump of 750 gallons per minute capacity, when pumping against 100 lbs. pressure per square inch, and the pump running at a speed of 100 r. p. m.

The question which we desire to have you settle for us is whether it is possible to draw water through this pipe laid in such a manner, even though the pipe is absolutely free from any leakage. In the first place we considered it an impossibility and have since looked up such authorities as were available and while, in a general way they seem to confirm our belief at the same time we would like to have a direct expression from higher authority upon these points, and finally decided to refer the matter to you for an opinion. T. R., Ambler, Pa.

It will require a little more than 3 feet velocity in a clean 10-inch pipe for it to discharge 750 gallons a minute. The head necessary to produce this velocity, the loss of head at entrance of pipe and in bends and the loss of head due to the flow of water in the pipe at the required velocity together amount to nearly 8 feet. The addition of the loss of head in the check valve might easily increase the total loss of head to 9 feet, so that, with the 1 foot of elevation of pump end of pipe above water in river, the total suction lift would be 10 feet. As the pipe becomes older the coefficient of discharge becomes less, reducing to ¾ at 20 years, which would increase the velocity to 4 feet and would increase the total loss of head fully 50 per cent. To this loss of head must be added that in the pump itself.

But the two summits in the suction would produce the most serious effect, for air would collect in them and very seriously reduce if not wholly stop the flow of water at times. The suction pipe acts to some extent as a siphon, and the action of the air in the summits will be similar. To insure continuous action and prevent the troublesome if not dangerous pumping of air by the water pump, therefore, it will be necessary to apply to both summits one or another of the devices in use for removing air from siphon summits. The pump cannot act regularly or at full capacity unless such devices are supplied, if it can be started without them. It would probably require complete priming also.

What points can our readers make and what suggestions?

Bookkeeping for Metered Water System.

In our borough we buy our water from the Trotter Water Company on the following schedule of prices:

For the first 5,000 gallons per day of 24 hours, 25 cents per thousand gallons; for all water used over 5,000 gallons per day and up to 10,000 gallons, 20 cents per thousand; for all water used over 10,000 gallons and up to 200,000, 15 cents per thousand gallons. The borough is the water company. Every citizen is taxed to pay for laying the main pipes and setting fire plugs, and where any one living in the borough takes water he has to pay for piping the house and setting the meter at the rate of 25 cents per thousand gallons. We have some difficulty in making out the tickets and collecting the bills. Will your system suit our plans?

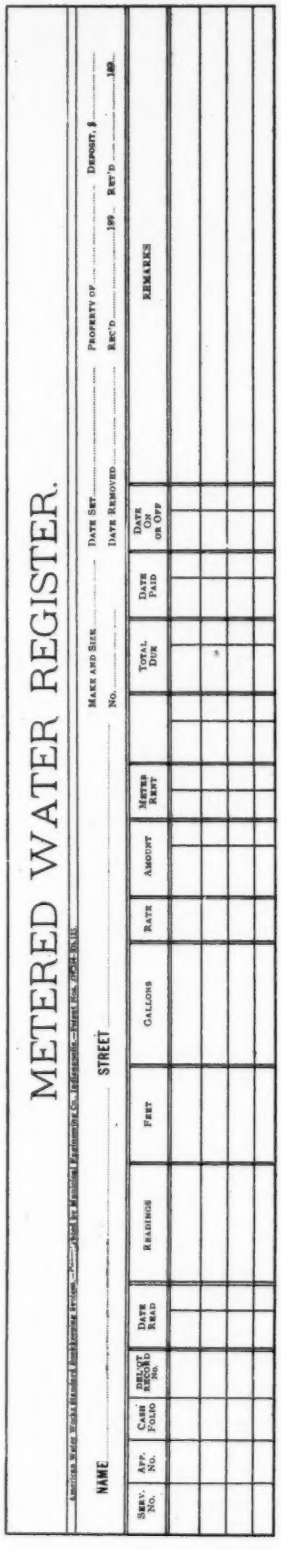
T. J. D., ——, Pa.

All the domestic users of water will fall under the first rate, so that the "Metered Water Register" in the "American Water Works Standard Bookkeeping System" will serve for keeping their accounts without modification.

A few manufacturers and such large users of water would be charged for water at two different rates, and a still smaller number at three rates.

For those who pay at two rates the following suggestion is made, assuming that meter readings are made monthly and are in cubic feet:

Assume that 150,000 gallons a month is the equivalent of 5,000 gallons a day. Write the total number of gallons used, as deduced from the meter readings in cubic feet, in the column headed gallons in red ink close under the line below. Deduct from this 150,000 gallons and write the remainder in black ink close under the red figures and on the line opposite the meter reading. Write the rate 20 in the column headed "Rate" and the amount due for the excess over 5,000 gallons at this rate in the column headed "Amount." Write in the column without heading $37.50, being the amount due for the first 150,-



000 gallons (5,000 gallons a day). It might be well also to have a stamp made reading "150,000 gal @ 25c" and stamp this in the column headed "Remarks." It is understood that there is no meter rent, so that the column headed "Meter Rent" can be used to enter the charge to pay for piping and meter setting at the rate of 25 cents a thousand gallons, computed from the red figures in the column headed "Gallons." If the charge ceases when the cost of piping and setting meter is all paid, the sum of the items in the column headed "Meter Rent" must be watched, so that the charge can be stopped when the total bill is paid. The total bill for the month will be the sum of the figures in the columns "Amount" and "Meter Rent" and the $37.50 in the column without heading. This column might have stamped or written in as a heading some such entry as "Chg at Max Rates."

A bill for this class of customers might be printed in the following form, all letters and figures given being printed and the blanks being filled out each month according to the computations from the meter readings:

Meter Reading ———— cu. ft. equal to ———— gal.

Charges for consumption:

150,000 gal. @ 25c. $37.50

———— gal. @ 20c ————

Charge for piping and meter setting:

———— gal. @ 25c ————

Total due $————

The sum of the 150,000 gallons and the ———— gallons at 20 cents should equal the ————gallons under the charge for piping and meter setting, and this latter amount is equal to the ———— gallons in the first line, "Meter Reading."

This bill is easily made out and is easily checked. The only additional information the customer could ask for is the standing of his account for piping and meter setting. A line stating his balance due on this account might be put in one corner of the receipt, or of the bill if it serves also as a receipt when it is stamped paid.

For the customers using more than 15,000 gallons a day the only changes necessary in the account book would be the insertion of $97.50 instead of $37.50 in the column without heading, and the use of a stamp for the column headed "Remarks," reading, "150,000 gal. @ 25c & 300,000 gal. @ 20c." The figure in the "Rate" column would be changed to 15 and the deduction from the red figure of total consumption would be 450,000 gallons to give the quantity to be paid for at the 15-cent rate.

The bill printed for this class of customers would have an additional line under that reading "150,000 gal. @ 25c.... $37.50," which line would read "300,000 gal. @ 20c....$60.00," and the next line would read, "———— gal. @ 15c....————."

The bill used for the domestic customers and others using less than 150,000 gallons

a month would be the same as the above except that the line for the 150,000 gal. charge would be omitted and the remaining line under the "Charge for Consumption" would read, "——— gal. @ 25c.... ——."

The above assumes that meters are not read daily, but that the daily consumption is averaged from the monthly readings.

The accompanying diagram of the book described will serve to make the description clearer.

Have our readers anything to suggest that would be applicable to this case?

Forms of Receipt for Water Bills.

Please give sample forms of receipts used for water works in small cities.

F. B. S. Byron, Ill.

Will our readers engaged in water works operation send us copies of the forms of bills and receipts they use for publication?

Following are some forms in use in the smaller cities:

Payable to....., City Treasurer,
City Hall, ...,..
No... .....Mass., ...191..
Mr.....
.....Street, Ward, ...
To City of....., Dr.

For Meter Advance from.....
1, 191.. to.....1, 191.. $.....
For Meter Rent from.....
1, 191.. to.....1, 191.. $.....
.....
....
$.....
Received Payment,
.....,
City Treasurer and Collector.

The face of the bill also bears the seal of the city, information about telephone calls and office hours, and the section of the water ordinance governing time of paying water bills. The back of the bill gives other sections from the water ordinance, including that governing rates.

Another form reads as follows:

If this bill is not paid in ten days after date, the water will be turned off. (In red.)

Hydrant.... ....., Ky., April 1, 191..
M.....
No....., ...Street.
To City Water Works, Dr.

Semi-Annual Water Rent for—
.....Dwelling $.....
.....Store .....
.....Extra Family .....
.....Bath .....
.....Wash Stand .....
.....Water Closet .....
.....Hose Attachment .....
.....Horse and Wagon .....
....

From this day to the 1st of October, 191.., upon the rules and conditions prescribed by law.

Received Payment, ..., 191..
.....
For the Works.

The back gives instructions, rates and regulations.

The following is a more complete form of bill for meter rates:

Register No...
Receipt No...
....., Minn., ... 191..
M.....
Premises.....
Water for Month of....., 191..

Meter this date .....cubic feet
Meter last month .....cubic feet
Consumption .....cubic feet
or .....gallons

....gals. at 20c per 1,000 gals. $.....
....gals. at 15c per 1,000 gals. $.....
....gals. at 10c per 1,000 gals. $.....
....gals. at 8c per 1,000 gals. $.....
$.....
Received Payment,
.....,
Water Commisisoner.
....., Deputy.

The face of the bill also carries the list of meter rates and instructions as follows: "Meter rates must be paid before the 10th of each month." "Please bring this bill with you." "7½ gallons in 1 cubic foot."

Following is a sample and convenient form of bill for flat rates:

Assessment for Water, No...
.....,
.....Street.
To City of....., Mass., Dr.

For Water from May 1, 191.., to May 1, 191.., as per items checked in schedule printed below. $.....

Then follows the water rate schedule for flat rates with a blank preceding each item for the check mark or number of fixtures under the item. Followed by the form

Received Payment,
.....,
City Treasurer.

A detachable slip for the treasurer's office reads:

.....Water No...
Amount $.....
Abatement $.....

The face of the bill carries the regulation concerning use of hose. The back of the bill carries extracts from the water ordinance and from the water board's regulations.

Criticism of these forms are invited.

Book on Water Works.

Gentlemen, would you kindly inform me what book you consider the best on water works and price of same.

J. D. M., Elko, Nev.

On the general subject of water works probably Turneaure and Russell's "Water Supply Engineering" ($5) is the best book. There are other excellent books, a list of the most important of which will be found in MUNICIPAL ENGINEERING, vol. xxxiii, p. 175.

Trouble with Suction at High Water.

Our company has a water works plant with a capacity of 1,500,000 gallons per twenty-four hours. Our suction pipe is a ten-inch line, which can be doubled if necessary. Our lift is on an average fifteen feet, sometimes a little more, sometimes less, during high water when my trouble occurs. My suction line is provided with an Eddy foot valve (check). This suction line is provided with a brass wire over the mouth to prevent trash from entering it. Now as soon as the water reaches a point above the foot valve, my pumps begin to labor, to plunge, to knock, and the water they pump falls off to less than half. The higher the water reaches on the suction line the greater the laboring of the pumps and the less they pump. Is the trouble in the "foot valve" or does trash collect on the mouth of the suction pipe?

SUPT. WATER WORKS, ——, Tenn.

Will our readers suggest causes for the difficulty and methods of remedying it?

There seems to be an obstruction to the flow of water in the suction pipe, which increases as the water in the stream rises. If the difficulty is proportional to the height of the water, decreasing as it falls the difficulty would seem to be in the foot valve or the pipe itself. If the difficulty increases irregularly and does not decrease materially seem to be from obstruc- trouble would seem to be from obstruction of the intake. In such case it would doubtless be necessary to clear the trash from the intake before the pumps would return to their normal action. The letter gives no indication that this is necessary, so that probably this not the cause of the difficulty. A sketch of the suction pipe and of its connections with the intake and the pumps, showing its grades and valves, also a full description or drawing of the foot valve and its setting would aid in locating the trouble.

Price for Water for Ice Plant.

What is the average cost or rate for water for an ice plant using say about 35,000 gallons a day for say 6 months in the year?

C. O., Newton, Iowa.

Such service would best be paid for by meter measurement and could very properly be charged at the average cost of supplying the water, with a small percentage added for safety. The total expense of the works for a year, including operation, maintenance, repairs, depreciation and interest, divided by the number of thousand gallons pumped per year would give the cost per thousand, and the price charged might well be larger than this cost by say 10 per cent. There are several items which may require special treatment in determining the price. Thus the figures for repairs should be somewhat larger than the average per year during the history of the existing plant, and not the figure for any one year. The allowance for depreciation or sinking fund should be ample. Estimates for water works plants run from 3 to 6 per cent. The interest item should include not alone interest on the bonded indebtedness but upon the total value of the plant. The cost of pumping may be higher during the ice making season on account of limitations in capacity of the plant, in which case proper addition should be made.

Charges for the quantity of water named in 20 cities, taken at random from the rate cards on file, run as follows: 3½, 7½, 8, 11¼, 15 cents per 100 cubic feet; 6, 6, 8, 9, 10, 10, 11, 12, 13, 14, 15, 17, 18, 20 cents per 1,000 gallons. It is evident that an average taken from such widely varying prices is not very liable to strike the proper rate for any one plant.

Price of Cast Iron Pipe.

Will you tell me what is a fair price for 4-inch cast iron pipe?

F. L. T., Roodhouse, Ill.

Late bids for 4-inch cast iron pipe have been for $26 a ton. Differences in freight charges may make slight differences in price for pipe in quantity at Roodhouse. Four-inch pipe weighs 200 pounds per 12-foot length for light pipe, 215 pounds for 150-foot head, 230 pounds for 250-foot head and 250 pounds for 350-foot head.

Motive Power for Small Water and Electric Light Plant.

Our plant is water and electric. Our electric generator is A. C., 3 phase, 60 cycle, 2,200 volts. We are now figuring on changing ouh old steam-driven Gordon pumps to a more economical pump. Would you recommend pumping engines, or motor-driven pumps? If the latter is recommended, what, in your judgment, is the best on the market?

P., ——, Mich.

The data given are not sufficient for an intelligent answer to the question. In fact the engineer attempting to answer it should have an opportunity to visit the plant and investigate all the conditions.

Will our readers who know about the operation of combined water and electric light plants in cities of 3,000 to 6,000 population give some of their information for publication for the benefit of our correspondent and others?

Cities Having Both Municipal and Private Water Plants.

Will you pleast inform me if you know of any cities in which there are both municipal and private water plants and the names of any such cities.

J. DAVIS REED,
Mayor, Portsmouth, Va.

Large cities, such as New York, Chicago, Los Angeles, Pittsburg, Indianapolis, Camden, Austin, Niagara Falls, have both municipal and private plants, on account of the annexation of adjoining small towns.

The following cities and towns are reported to have two or more water plants,

one of which is under municipal ownership: Mobile, Ala.; Jacksonville, Fla.; Pueblo, Col.; Petersburg, W. Va.; Shenandoah, Millvale, Pa.; Gloversville, N. Y.; Nome, Alaska; East Providence, R. I.; Tyler, Tex.; Santa Rosa, Santa Barbara, Santa Cruz, Cal.; Montpelier, St. Johnsbury, Vt.; Grand Haven, Niles, Mich.; Cherryvale, Kan.; Montpelier, Ind.

There are also a number of places, most of them in New Jersey, where the water is supplied by a company and is distributed by the city. And there are other cities which own all or part of the water works plant and lease it to an operating company.

The latest report giving full details is in the "Municipal Year Book" for 1902 ($4), and there are doubtless some changes in the list since that date.

Books on Electrolysis.

Is there a book treating on electrolysis of water pipe, caused by electric railways, and the prevention of same?

J. P. L., Greenville, O.

Lists of books and articles on Electrolysis will be found in MUNICIPAL ENGEERNING, vol. xxxvii, p. 107.

Articles on Electric Wires and Lighting.

Could you let us know which numbers within the last two years have articles on electric street lighting and electric wires in streets? Some of our New Jersey municipalities are very much interested in this at the present time.

J. E. B., New York, N. Y.

The following are articles on the above subjects:

Vol. xxxiv, p. 235, "Flaming and Metallic Arc Lamps," defining the terms; p. 268, "The Duluth, Minn., Electric, Gas and Steam Engine Pumping Stations," a brief descriptive article, illustrated; p. 299, "Cost of Water, Gas and Electric Light," giving a list of prior articles on that and kindred subjects; p. 306, "Tests of Electric Lamps," a review of a bulletin of the University of Illinois; p. 370, "A Flaming Arc Lamp," giving a description of the Janders type; p. 371, "Specifications for Street Lighting," giving those prepared by a committee of the National Electric Light Association.

Vol. xxxv, p. 35, "Cost of Operating Municipal Lighting Plants," giving references to sources of information on the subject; p. 96, "Principles Underlying a Street Lighting Contract," as laid down by a committee of the Civic League of St. Louis; p. 234, "The Arc Lighting System of Portland, Ore.," a descriptive article; p. 383, "Prices of Water and Light," giving references to sources of information.

Vol. xxxvi, p. 33, "Rates for Lighting and Contract Provisions," giving rates in New York villages, and an outline of a contract of a city with a lighting company; p. 216, "Tungsten Lamps Compared with Arc Lamps"; p. 241, "Will Electric Light Plant Be Profitable," a brief statement of the matters to be considered; p. 315, "Information About Municipal Water Supply and Electric Light Plants," giving references to sources of information; p. 316, "Forms of Contract for Electric Current," giving contracts of municipal and private lighting plants with customers; p. 373, "Municipal Street Lighting Plant"; p. 390, "Report Adverse to Municipal Lighting in Spokane," a brief news note.

Vol. xxxvii, p. 37, "Terms for Renewal of Lighting Franchise," giving references to sources of information; p. 175, "State Regulation of Electric Light Rates," an editorial; p. 181, "Concrete Lamp Posts"; p. 189, "Cost of Street Lighting in Des Moines, Iowa"; p. 257, "Cities Owning Water and Light Plants," giving list of cities of 3,000 to 4,000 inhabitants; p. 324, "Cost of Electric Current," giving figures for cities from 75,000 to 125,000 population; p. 326, "Tungsten Lamps for Street Lighting," a brief note of progress; p. 397, "Water and Lighting Rates in Small Cities," and "Rates for Electric Current," giving references to sources of information.

Vol. xxxviii, p. 10, "Gas and Electric Competition About Boston"; p. 15, "Street Lighting"; p. 44, "Arc and Other Electric Lights," giving comparisons of experiences, costs, etc.; p. 107, "Books on Electric Light and Gas Plants," giving lists of books and articles; p. 108, "Distribution of Charges for Electric Power," showing how to make rates on maximum demand system.

List of Municipal Electric Light Plants.

Where can I get a list of municipal electric light plants with the names of officers, kind of motive power and other information?

A. D. E., St. Louis, Mo.

The *McGraw Electrical Directory* probably gives the information desired. It is published semi-annually at $10 a year.

Municipal Lighting Plant with Water Power.

I am told that you have some literature regarding the municipalization of the electric light by water power. As we intend to submit this case to the citizens of the town, you will greatly oblige me by sending a copy of this printed matter, if possible.

E. B., ——, Que., Can.

The only full discussions of this subject are in such books as Frizell's "Water Power" ($5); Lyndon's "Development and Electrical Distribution of Water Power" ($3); Beardsley's "Design and Construction of Hydro-Electric Plants" ($5); Adams's "Electric Transmission of Water Power" ($3), which can be furnished by MUNICIPAL ENGINEERING COMPANY at the prices quoted.

There are many articles on the municipalization of electric light plants without particular reference to the use of water power which can be found in the volumes of MUNICIPAL ENGINEERING. Lists of such articles will be found in vol. xxxviii, p. 107, vol. xxxvii, p. 324, etc.

Information About Municipal Lighting Plants.

There is very strong sentiment in this city in favor of a municipal electric lighting plant and we wish advice as to the cost of such a plant for a city of this size, namely about 25,000 population, and information as to where municipal lighting plants in cities of about this size have been installed. If you can give us any information as to the cost, we should appreciate the same and would likewise appreciate the information relative to the financial results where municipal plants have been installed in cities similar in size to our city. In fact, any information you can give us which you think will be of benefit in the matters referred to, I should like. If you are not able to furnish the data requested, if you can refer us to some person or company from whom we can obtain the same, it will be likewise appreciated.

W. E. G., ———, O.

The following data regarding municipal electric light plants are taken from the *McGraw Electrical Directory*, which also gives the details of equipment and contracts:

Argenta, Ark., 15,000 population, plant cost $60,000. City is charged $75 each for 69 arc lights.

Little Rock, Ark., 40,000 population, plant cost $55,000; 340 city arc lights.

Alameda, Cal., 20,000 population. City is charged $78 each for 500 24-c. p. incandescents.

Pasadena, Cal., 15,000 population, plant cost $350,000. City is charged $60 each for 308 arc lights and $12 each for 750 40-c. p. incandescents.

Norwich, Conn., 20,000 population, plant cost $690,896. Also buys current. City is charged $75 each for 235 arc lights and $15 each for 295 25-c. p. incandescents.

Jacksonville, Fla., 37,000 population, plant cost $520,872. City is charged $54 and $60 for 520 arc lights and $25 each for 166 59-c. p. incandescents.

Bloomington, Ill., 26,000 population, cost $40,000, has 420 arc and 400 16-c. p. incandescent lights, for street lighting only. Plant is under reconstruction.

Decatur, Ill., 25,000 population, cost $45,000, has 240 arc lights, for street lighting only.

Galesburg, Ill., 21,000 population, cost $40,000, has 200 arc arc and 550 incandescent lights, for street lighting only.

Jacksonville, Ill., 17,000 population, for street lighting only.

Springfield, Ill., 38,000 population, has 608 arc lights, for street lighting only.

Anderson, Ind., 21,000 population, cost $157,000. City is charged $70 each for 255 arc lights.

Fort Wayne, Ind., 51,000 population, has 420 arc lights for street lighting.

Hammond, Ind., 40,000 population, has street lighting plant.

Huntington, Ind., 20,000 population, 121 arc lights, for street lighting.

Marion ,Ind., 25,000 population, cost $24,000, 250 arc and 75 incandescent lights, for street lighting.

Richmond, Ind., 20,000 population, cost $212,000. City is charged $75 each for 315 arc lights.

Topeka, Kan., 42,000 population, cost $85,000, for street lighting.

Henderson, Ky., 17,500 population, cost $109,000.

Paducah, Ky., 23,000 population, cost $20,000. City is charged $51 each for 214 arc lights, for street lighting.

Bangor, Me., 25,000 population, has 410 arc and 1,800 incandescent lights.

Cumberland, Md., 20,000 population, cost $18,286, has 298 arc lights.

Hagerstown, Md., 16,000 population, $55,000 bonds authorized, has 310 arc and 5,000 incandescent lights.

Chicopee, Mass., 21,000 population, cost $142,481. City is charged $75 each for 225 arc lights and lights two other villages.

Holyoke, Mass., 51,000 population, cost $380,469. City is charged $60 each for 518 arc lights.

Taunton, Mass., 31,000 population, cost $125,000. City has 254 arc and 816 40-c. p. incandescent lights.

Bay City, Mich., 41,000 population, cost $78,000. City is charged $55 each for 444 arc lights.

Kalamazoo, Mich., 33,000 population, cost $65,000. City is charged $44 each for 380 arc lights.

Lansing, Mich., 23,000 population, $135,000 bonds. City has 230 arc lights.

Joplin, Mo., 45,000 population, cost $75,000. Has 250 arc and 3,000 incandescent lights.

Lincoln, Neb., 49,000 population, cost $85,000. City is charged $50 each for 330 arc lights.

Jamestown, N. Y., 27,000 population, cost $140,000. City is charged $51 each for 425 arcs and $18 for 32 48-c. p. incandescents.

Ashtabula, O., 16,000 population, cost $80,000. City has 130 arcs and 20 incandescents.

Hamilton, O., 28,000 population, cost $100,000. City has 365 arc and 125 tungsten lights.

Newark, O., 21,000 population, cost $65,000. City has 359 arc lights costing $17.25 a year each. For street lighting only.

Norwood, O., 21,000 population. Has municipal water and light plant which cost $125,000.

Easton, Pa., 29,000 population, cost $54,000. City has 300 arc lights. For street lighting only.

Norristown, Pa., 24,000 population, cost $43,368. City is charged $41.10 each for 216 arc lights, for street lighting only.

Austin, Tex., 23,000 population, has municipal water, light and power plant which has $1,300,000 outstanding bonds. City is charged $60 each for 188 arcs and 5 cents per kw. for 800 16-c. p. incandescent lights.

Galveston, Tex., 35,000 population, cost $25,000, has 500 arcs and 500 incandescents, for street lighting only.

Burlington, Vt., 22,000 population, $100,000 bonds. City is charged $65 each for 243 arc lights.

Danville, Va., 18,000 population, has municipal plant.

Tacoma, Wash., 38,000 population, cost $287,000, buys current at present. City is charged $72 each for 1,000 arc lights.

Wheeling, W. Va., 42,000 population, cost $100,000.

It is evident that the cost of the plant depends upon more than the size of the city. The best means of getting information concerning the financial results of operation of plants is through correspondence with the managers and study of their reports.

It is recommended that the proper department in the city from which the inquiry comes secure expert advice from an electrical engineer of good standing. Names of such engineers will be found in the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the headings "Civil Engineers" and "Consulting Engineers."

Books on Gas Plant Design.

Can you refer me to a good book or books that will assist me in making plans for a gas works for a city of 10,000 inhabitants? D., —— Ind.

The plant would probably be a water-gas plant, in which case some design on the market would probably be selected. Latta's "Handbook of American Gas Engineering Practice" ($4.50) will give a good view of the whole field and aid in making the proper selection of process and machinery. Newbigging's "Handbook for Gas Engineers and Managers" ($7) gives a view of English practice. Cripps's "Gas Holder and Tank Construction" ($1.50) and Hole's "The Distribution of Gas" ($5) are both English works and probably the best on their subjects. Hunt's "Gas Lighting" ($3.50), being the third volume of "Chemical Technology," is a good book. Webber's "Town Gas for Lighting and Heating" ($2) will give information about coal-gas plants. O'Connor's "Gas Engineers' Pocket-Book" ($3.50) contains tables and data.

Repressed vs. Plain Wire-Cut Brick.

During recent years most cities have adopted specifications for brick paving calling for repressed block, and text-books and other publications hold up the repressed block as the standard of excellence. In the face of these facts, the Dunn Wire-Cut-Lug Brick Company advertises its product by the circulation of literature designed to prove that the brick lose considerably in both density and toughness by the process of repressing, and quoting prominent brick manufacturers and others in confirmation of this statement.

If paving blocks lose instead of gain in quality in the process of repressing, how has it come about that the repressed block has been manufactured and used for a number of years to the almost total exclusion of the non-repressed block?

Do you know of any investigations or series of tests by disinterested parties to determine the effect of the repressing process on the quality of the product?

E. R. WHITMORE,
City Engineer, Port Huron, Mich.

This is a question which is open to discussion and MUNICIPAL ENGINEERING will publish contributions to the discussion if our readers will send them for that purpose.

The prevailing opinion about repressing brick is expressed by Professor Baker in the paragraph on repressing in his book on "Roads and Pavements" ($5). It is to the effect that repressing makes the brick more symmetrical, but, with variations due to character of clay and method of manufacture does not increase its solidity or decrease its laminations.

Repressing came into favor about 1895, but few repressed blocks having been laid prior to that year. There was much opposition to the process then, among manufacturers and engineers, and that opposition has not diminished. The writer laid the first repressed block street in Indianapolis in 1895, a heavily traveled pavement which is still in use. The fillers in general use in those days did not protect the edges of the brick and they soon chipped off, unless they were rounded in the repress. The fillers would not run into the joints unless the bricks were laid to give the joint, resulting practically in a rough, irregularly jointed surface, or projections or grooves were formed in the repress. These practical considerations and the improvement in appearance seem to have been the principal reasons for the sudden popularity of the form. There were also early claims of greater density and toughness.

Professor H. A. Wheeler, in his booklet, "Vitrified Paving Brick" ($1), published in 1895, which was the first technical treatment of paving brick and is still the best, aside from official reports on various parts of the subject, doubts the benefit to the brick, on account of the breaking up of the bond formed in the die by the differently applied pressure in the repress. He accounts for the slightly smaller abrasion loss by the greater breaking off of corners of square cornered brick in the early period in the rattler.

A booklet on "Brick Pavements" by W. W. Wallace, published the same year, shows the popularity of the repressed form by statements of specifications, Chicago, Louisville, Philadelphia requiring repressed bricks.

In the same year, 1895, the National Brick Manufacturers' Association appointed a committee on Technical Investigation, which made a series of tests and published a report in 1901 ($1). One section of this report is devoted to a comparison of the wearing qualities of plain and repressed brick. The results of these tests show a decided advantage of the plain bricks over the repressed in that

their losses in the rattler are in the average over ten per cent. less. The advantage is greater in the case of end-cut than in the case of side-cut brick, although there are three cases out of eleven in which the repressed end-cut brick show a slight advantage over the plain end-cut, while there is only one instance in which the advantage is with the repressed side-cut brick.

The repressing is shown to reduce the co-efficient of thickness, as the length and breadth are expanded in the repress at the expense of the thickness, thus making the brick less able to endure the rattling test and presumably the street wear also. The results are shown to corroborate this reasoning and to such an extent as to overcome the known disadvantage of the plain bricks in the rattler on account of the knocking off of the sharp corners before the real abrasion test begins.

There is a rather inconclusive series of experiments on the effect of the flow of the clay in the repress, which tends to show the weakening effect of breaking the bond formed in the clay ribbon from which the bricks are cut.

The conclusions are that the superiority of the plain wire-cut product should be assumed until thorough tests have shown that this is not true with reference to the particular product of a particular factory.

In 1902, eleven city engineers in Iowa expressed preference for repressed brick; three for plain brick, and three had never used any but plain brick and had no experience on which to base an opinion. No reasons were given for the preferences.

With modern methods of applying fillers so as to protect the corners of bricks and lugs on non-repressed bricks of proper form to insure filled joints, the principal reasons for using repressed blocks are removed and manufacturers and users may often save the expense of the repressing.

Books on Highways and Gypsum Manufacture.

Will you please inform me where I can secure a few good books on highway construction. Also give me some information regarding the establishing of a gypsum works, costs, etc.

L. A. B., Mangum, Okla.

Good books on highway construction are Byrne's "Highway Construction" ($5); Aitken's "Road Making and Maintenance" ($6), an English book; Morrison's "Highway Engineering" ($2.50), arranged in order of the preference of the writer. Baker's "Roads and Pavements" ($5) is also a good book if its arguments on earth roads are not taken to mean that really good roads are obtained by the methods proposed.

The manufacture of plaster from gypsum is fully described in Eckel's "Cements, Limes and Plasters" ($6) with data for estimates. MUNICIPAL ENGINEERING Co. can supply the books at the prices named.

Granulated Slag for Brick Pavement Foundation.

We are doing dry foundation paving with brick or block surface and sand filler We find it desirable because of easy access for necessary improvements and repairs under the paving. We are ordinarily using gravel for foundation and have used coarse broken furnace slag, but it is not readily available on account of the newer system of granulating the slag which the furnaces are now following. It is suggested to use this granulated slag as a foundation. Can you inform me of any instances or endeavors for its use in such case either favorable or otherwise? The state aid pavement on East Palestine Road, shown in the fifth annual report of State Highway Department of our state, used the material for cushion coat under the brick, on concrete foundation. It has quite a marked cementing property when left standing in mass, and with abundant rolling I can see no reason why it could not be used, and there would be a desirable saving in cost.

C. E., East Palestine, O.

Can our readers give any information on this subject?

Would not the mixture of a proportion of quicklime with the granulated slag produce a still greater solidification of the foundation? Puzzolan cements are made by grinding together slag and lime to a fine powder and the simple mixture of the lime and slag without grinding should give opportunity for a certain amount of chemical combination which would make concrete of the foundation. The question then arises, whether the mixture of a proportion of larger aggregates, broken stone, gravel or crushed slag, not granulated, would not still further cheapen the foundation without weakening it, or possibly with the effect of strengthening it.

If our readers can not report experiments along this line it seems worth while to make them where the slag is available.

The objection made to plain broken stone or gravel for foundation is that it is impossible to make a foundation which will not settle unevenly under the influence of traffic, weather and subsurface conditions. The mortar is added so that the foundation under the brick will be strong enough to distribute the loads on the pavement over sufficient area to reduce the danger of unequal settlement as nearly to zero as possible. When the pavement is cut into for trenches the subfoundation and the broken stone or gravel foundation can never be replaced exactly as before and the danger of unequal settlement is greatly increased. If concrete is used for a foundation, enough extra concrete can be used in replacing the foundation over the trench to insure that the repaired portion shall keep its place as well as the undisturbed portion. The necessity of frequent cuts in the pavement is therefore an argument in favor of a concrete foundation, and is emphatically not an argument for a foundation without cement. It is true that it costs less to make a cut and replace the pavement when the foundation is not concrete, but it is also true that the pavement cannot be

equally well replaced and that the pavement will deteriorate more rapidly and require replacement at an earlier day, so that even the argument of less cost of cutting the pavement and repairing it loses its force when all the cost is taken into consideration.

Paving Materials and Construction for Small Towns.

We desire to get some prices and information on paving materials and paving construction suitable for small towns. We desire to have some information on the matter that we may know what the difference is in different materials in cost, etc., and what will be the best for us to use. L. M., Lexington, Neb.

A good book from which much on this subject can be learned is Baker's "Roads and Pavements" ($5). Another good book which is brief and yet comprehensive is Judson's "City Roads and Pavements" ($2), which is prepared with special reference to the needs of small cities and towns.

There are many articles in MUNICIPAL ENGINEERING which will give information on the subject such as the following:

In vol. xxxviii: "Cost of Wooden Block Paving in Indianapolis," p. 42; "Narrowing Roadways in City Streets," p. 111.

In vol. xxxvii: "Materials for Tarring Roads," p. 18; "Street Width," p. 107; "German Artificial Stone Paving," p. 121; "The Cost of Adapting Macadam Roads to Automobile Traffic," p. 142; "Cost of Pavements," pp. 152, 177; "Sidewalk and Curb Design and Construction," p. 164; "Specifications for Cement and Stone Sidewalks, Curbs and Gutters," pp. 178, 206; "Concrete for Street Crossings," p. 180; "Automobile Proof Roads," p. 201; "Dust Abatement by Surface Applications," p. 236; "Specifications for Bituminous Macadam Pavements," p. 254, giving a number of references to previous articles on the same subject; "Indianapolis Specifications for Bituminous Macadam Pavement," p. 261; "Specifications for Making Macadam Road with Liquid Asphalt Binder," p. 274; "Tar in the Surface Treatment of Roads," p. 297; "Some Examples of Street Design," p. 307; "County Highways," p. 310; "Somerville's Experience with Tarvia," p. 346; "Three Years of Experience with Oiling Roads," p. 381.

In vol. xxxvi: "Efficiency of Concrete Pavements," p. 32, containing also references to prior articles on this form of street paving; "Amount of Pavement of Various Kinds," p. 117; "An Improved Form of Paving Brick," p. 130; "Construction of an Asphalt Street," p. 223; "Articles on Concrete Pavements," p. 245, giving references to articles on the Blome concrete pavement; "Cause and Prevention of Defects in Asphalt Pavements," p. 307; "Concrete Street Pavements," p. 312; "Experiments on Bituminized Macadam Pavements," p. 358; "Qualities of Paving Brick," p. 367; "Liquid Asphalt for Treating Macadam Roads," p. 396; "Road Preservation with Tarvia," p. 400.

These articles are distributed through all the numbers for 1909 and 1910, and there are many others in preceding volumes.

Methods of Assessing Cost of Sewers and Pavements.

I would be glad to see published in your Question Department a list of any articles which may have appeared in MUNICIPAL ENGINEERING within the past four or five years relating to special assessments for sewers and the name of any book or other publication of which you may have knowledge which covers this ground thoroughly.

The method in use here for many years past is to assess each sewer separately when it is built, assessing the cost of manholes, catch basins and sewers crossing street or alley intersections or opposite public property to the city, and the balance to property benefitted, the assessment district being fixed by the Common Council. The charter provides that each lot may be assessed for one main and one lateral sewer. Thus, when a main sewer is built all the property which will eventually be sewered to it is assesed to pay the exsewered to it is assessed to pay the exlaterals are built each lateral is assessed to the property immediately benefitted.

One very serious objection to the method above outlined is that in many cases a main or lateral sewer is built for a few blocks only, but must be built at such depth and of such size that later, when the property further out shall become sufficiently developed to require it, it can be extended for a considerable distance. Thus the property near the sewer outlet is compelled to pay the expense of a large and deep sewer at a cost which is sometimes nearly equal to the value of the property; and later when the sewer is extended the property farther out is assessed for a small and shallow sewer at very light expense. The purchaser or owner of a lot for which a sewer has not been built does not know whether it will cost him one mill or one cent per square foot of property to get a sewer.

Our method of assessing the cost of pavements is the common one of assessing to abutting property the entire cost of the pavement opposite same, the city paying for street intersections. This is also unjust in many cases, though not so flagrantly so as the method of assessing sewers. A lot 25 by 100 feet on a corner may have 100 feet of pavement to pay for, while the lot next it is not assessed a cent.

Any information which you may be able to give me as to more equitable methods of special assessment will be greatly appreciated.

E. R. WHITMORE,
City Engineer, Port Huron, Mich.

The method of assessing cost of street intersections is discussed in the February number, vol. xxxviii, p. 110; also in vol. xxviii, p. 102.

The front foot rule of assessing cost of streets and sewers and the modifications that are permissible in some states to provide for the side streets running lengthwise of corner lots are discussed in vol. xxxvii, p. 327, and references are made to many court decisions on the subject. Its application in Knoxville is shown in vol. xxix, p. 434, and in Mankato, vol. xxviii, p. 242.

The methods in vogue in various states are stated briefly in vol. xxxv, p. 116; and the methods of making pavement assessments and collections in Detroit are stated in considerable detail in vol. xxxv, p. 367, and briefly for Grand Rapids in vol. xxix, p. 371.

The limitation of assesment to a proportion of the value of the property in St. Louis is shown in vol. xxix, p. 106, and in Louisville, in vol. xxviii, p. 241.

The theory of assessments for public improvements is discussed in articles in vols. vii, p. 82; xii, pp. 39, 154, 179; xiii, pp. 168, 372; xiv, pp. 38, 94; xv, pp. 215, 251; xvi, pp, 312, 313, 398; xviii, pp. 188, 247, 252; xx, pp. 149, 277, 354; xxi, p. 180; xxii, pp. 21, 157, 234; xxiv, p. 428; xxvi, p. 25. See also the article following.

A charter provision limiting the number of sewer assessments to two, one main and one local would work injustice on some property unless the main sewers were all construted and the assessments made for them at the same time. In large districts especially if they are not fully settled, this is practically impossible. Sometimes it is necessary, in order to treat all the property equitably, to make several assessments for main sewers. The writer knows of one piece of property which received four main sewer assessments and one local sewer assessment, simply because it was more convenient to make the contracts for construction in five sections. The sum total was no more, however, than it would have been if all the work had been let in one contract.

Mehtods of Assessments for Sewers.

I am at present attorney for village of Phoenix in the matter of installing a new sewer system. The village has filed a map and plan for complete sewer system for the village with the state department as required by our statute. The village board passed a resolution submitting to a vote of the taxpayers the question as to whether or not sewers should be built in Canal street in this village from Bridge street to Brandy brook, which proposition was carried and a general tax voted to pay for the construction. The general village law provides that sewers may be built wholly at the expense of the village or partly at the expense of the village and partly at the expense of property owners. This portion of the sewer so constructed has just been completed and paid for by the village. This is a trunk sewer running through the main street of the village, into which lateral sewers will empty. There are sewers in other streets which now are or will be connected with this main sewer. A committee was appointed to investigate and advise the village board whether or not parties wishing to use this new sewer or any village sewer should be charged a special rate or tax for the privilege of making connection. This committee has made a report to the board of trustees, a copy of which I enclose.

I have been asked to prepare an ordinance along the lines suggested by the committee. Will you please advise me what information you have with reference to matters of this kind and what authorities, if any, you can refer me to which will assist me in framing the proposed ordinance to meet the situation as presented in this village?

E. M. WHITE,
Syracuse, N. Y.

The committee report referred to follows:

After an investigation covering the entire state of New York of the mode of assessing sewer assessments, we, the committee, appointed by your president, recommend that the following rules be observed in relation to parties using or proposing to use the new trunk sewer or any extensions or additions thereto:

1st. That an outlet tax of $15 be assessed against each residence or business place and $25 against each hotel, club room or manufactory employing twenty-five or more people. The object of this being to pay the increased cost of the main or trunk sewers over that of the smaller sized sewers which will be used in the residential portions of the village.

2nd. That each property draining into the aforesaid sewer or any connections therewith shall pay a frontage tax of thirty cents per lineal foot for each lineal foot said sewer or any connections therewith may extend along said property.

3rd. A tributary or connecting sewer for assessment purposes must have been constructed wholly or in part at the expense of the village and in such a manner that said sewer may, in the opinion of the engineer, properly become a part of the general sewer system in accordance with plans which have been adopted and approved.

4th. Any property abutting on sewers not built wholly or in part at the expense of said village and which connect directly or indirectly or which may hereafter connect with said trunk sewer, shall be assessed the outlet tax only, as prescribed in Section 1. But this privilege shall not render said property exempt from frontage tax if at any time a sewer shall be laid in conformity with the general sewer plan along said property.

5th. If, at any time, it shall be found for the interest of the village to use any sewer already constructed at private expense as a part of the general sewer system, the owner or owners of the property or properties for whose benefit said sewer was constructed, shall be recompensed for said sewer in a proper amount, but the property or properties thereafter shall be subject to the same assessments as any other like property or properties.

The committee report follows the principles generally acecpted as proper in distributing sewer assessments. These principles are discussed in some detail in MUNICIPAL ENGINEERING, vol xv, p. 215, and vol. xviii, p. 252. Other shorter articles may be interesting also.

A. In brief, the city at large is benefited by the sewers in that its sanitary condition is improved and the service attracts business and residents, or at least the absence of the sewers would repel prospective new citizens. The city at large should therefore pay a portion of the cost of the entire system. This portion may be represented by the cost of construction, maintenance and operation of a sewage purification plant in case one is necessary.

B. The presence of the sewer in the

street is a direct addition to the value of the property, which may be assumed to be proportioned to its area, especially if the sewers carry storm water as well as sewage. The property draining directly into the sewer should therefore pay a part in proportion to its area.

C. Usually the outlet sewers are constructed before the whole system is demanded. In such cases they must be made large enough so that they can carry the sewage from the branches when they are constructed. A portion of the cost of such outlet sewer should therefore be assessed on the whole district which will ultimately drain into it. This will be in proportion to the area also.

D. It is probably true that an improved property gets more benefit from the sewers than one which is not improved. Large users are certainly more benefited. Some portion of the cost should therefore be assessed in proportion to the value of the property or the amount of use made of the sewers or both.

The proportion of the cost to be assigned to each of these assessments is discussed to some extent in the articles referred to. It will vary as local circumstances vary to some extent.

Assuming that the assessments proposed in the committee report are in proper proportion, its first item provides for the classes of assessments in paragraphs C and D; that in the second item for B, using frontage instead of area, which is exactly correct if all lots are of the same depth; the third item seems to define the application of the assessments to fit a local condition; the fourth item provides directly for paragraph C in case of local sewers already constructed and is therefore correct; the adjustment for previous construction by private parties of sewers to be taken for public service should be made so that the private owners of the sewer will have paid their fair share of the cost and shall be reimbursed for any excess. Unfortunately such sewers are seldom in shape to adopt and must often be replaced, in which case the property may properly be required to pay its full share of the cost of the new sewer, the old sewer being a total loss to them. Sometimes a partial rebate may be equitable.

Among the articles of interest in considering this question are the following in MUNICIPAL ENGINEERING, not all of them being directly applicable to the details: vol. ix, p. 242; vol. xii, pp. 105, 154, 184, 372; vol. xiii, pp. 154, 372; vol. xiv, pp. 38, 313; vol. xv, pp. 215, 322; vol. xvii, pp. 32, 33, 97; vol. xviii, pp. 73, 247, 252; vol. xxi, pp. 82, 174; vol. xxiii, p. 168; vol. xxv, pp. 257, 380.

Concrete and Clay Products for Sewers.

I want information in regard to concrete sewers as compared with clay products. E. J. H., Chehalis, Wash.

Probably the fullest unbiassed discussions of the subject will be found in the volumes of MUNICIPAL ENGINEERING. The following articles give more or less information on the subject.

In vol. xxxvii; "Experience With Concrete Sewers," p. 34; "The Destruction of Concrete by Alkali," p. 112; "Concrete Sewer Pipe for Denver, Col.," p. 203; "Articles on Effects of Acids and Alkalies on Reinforced Concrete," p. 183; "Concrete and Brick Sewers," p. 253.

In vol. xxxvi: "Limestone in Concrete for Sewers," p. 36; "Durability of Concrete Sewers," p. 108; "National Hydraulic Cement Sewer," p. 182; "Concrete and Vitrified Pipe for Sewers," p. 379.

In vol. xxxv: "Concrete Sewer Pipe," p. 102; "Durability of Cement and Concrete in Sewers," p. 114; "Concrete and Brick for Sewers," p. 178; "Effect of Alkali Soils and Water on Concrete," p. 37; "Salt and Sea Water for Mixing Concrete," p. 381; "Effect of Salt and Alkali on Concrete," p. 385.

In vol. xxxiv: "Concrete Sewer Pipe," p. 358; "Phenomena of the Crushing of Sewer Conduits," p. 292.

In vol. xxxiii: "The Testing of Clay and Concrete Pipes," p. 240.

In vol. xxxii: "Effect of Frost on Concrete Pipe," pp. 247, 318; "Cement Sewer Pipe," p. 263.

In vol. xxxi: "The Physical Phenomena of the Penetration of Cement by Sea Salts," p. 54; "Effect of Sulphur in Concrete Aggregate," p. 447.

In vol. xxx: "Effect of Sewage on Concrete," p. 136; "The Decomposition of Cements in Sea Water," p. 441.

In vol. xxix: "Experiments on Steel-Concrete Pipes," p. 353.

In vol. xxviii: "Material for 36-Inch Sewer," p. 233.

In vol. xxvii: "Cement Sewer Pipe," p. 113.

In vol. xv: "Testing Sewer Pipes of Cement and Clay," p. 257.

Information About Cameron Patents on Sewage Purification Processes.

I shall be very glad if you can find for me any information of value in your files, concerning the Cameron patent, and especially concerning the instances of the prior art tending to show the non-patentability of the Cameron tank.

G. H. C., ———, Iowa.

The most logical explanation of the decision of the Federal Court in favor of the Cameron patents is that made by Prof. A. Marston in a paper on "Septic Tank Patents" before the League of American Municipalities, printed in MUNICIPAL ENGINEERING, vol. xxxv, p. 288. There in an editorial on "The Septic Tank Patent Litigation" on p. 311, which calls attention to a tank designed by the writer and built some years before the Cameron patents were applied for, and suggests the similarities and differences. There is also an editorial on "Septic Tank Patents Sustained" in vol. xxxiv, p. 94, describing the

tank in some detail. The main point in the decision is stated on p. 107 of the same number in an article entitled "Patents on Sewage Purification Process Sustained." Some correspondence on the question and editorial comment thereon will be found in vol. xxxiv, p. 303, in "The Septic Tank Question." References to many other articles on the process will be found in vol. xxxvi, p. 241, in an article giving "Information About Septic Tanks and Sedimentation of Sewage"; also in vol. xxxiii, p. 249, and vol. xxxi, p. 280.

Methods and Cost of Street Cleaning and Sprinkling.

Our city is contemplating the cleaning and sprinkling of its paved streets by contract, and I am seeking data of costs per unit of 1,000 yards per annum. Can you furnish me with a list of cities in Indiana doing this work by contract, together with the cost of same? I do not know of any small cities contracting such work.

W. S. F., City Engineer, ———, Ind.

Can our readers supply the desired information? That from small cities in other states will be acceptable for there are few such cities in Indiana which do street cleaning by contract and street sprinkling is usually done by private contract with property owners or tenants rather than by city contracts.

The city of Indianapolis has a street cleaning and sprinkling department which does the work for the entire city. Formerly it was done by contract and the figures of cost are given in an article in MUNICIPAL ENGINEERING, vol. xvi, p. 384, street cleaning being reported to cost from 19 cents up per 10,000 square feet each time for machine cleaning and street sprinkling $20 to $45 per 10,000 square feet of street per season. Figures of cost in several larger cities are also given.

A very interesting comparison of cost of cleaning streets under various conditions will be found in vol. xv, p. 40, showing the effect of the kind of pavement, its condition, amount of traffic, presence and condition of street car tracks and of pavement between tracks and character of population on the street. Thus wood, brick and asphalt pavements in good condition cost about the same to clean, and the cost increases as the condition becomes bad up to 40 per cent additional. A street with dense traffic costs up to 250 per cent more to clean than one of light traffic. Street car rails increase the cost 10 to 20 per cent. Blocks adjoining unpaved streets cost 100 per cent more than wholly paved districts. Estimates of cost in New York city are based on these percentages of increase and an observed cost for keeping clean asphalt pavement in good condition on a light traffic street of 69 cents per 1,000 square yards or 76 2-3 cents per 10,000 square feet per week.

In vol. v, p. 201, is an article comparing the cost of hand and machine sweeping and flushing in Indianapolis, giving details of labor cost and all items. For daily cleaning by hand with flushing once in two weeks, the cost is computed on the basis of about 50,000 square feet per man at $1.50 per day. The man's labor costs about $50.25 per 10,000 square feet for the season, from April 1 to November 1. Carting off the sweepings at 70½ cents a load cost $14.26. Hand tools, interest on plant and renewals cost 88 cents. Flushing 15 times at $20.75 each cost $11.79 and the profit to the contractor at 15 per cent was computed as $12.00. This makes the total cost for the season per 10,000 square feet $92.18, or for the 211 days the cost would be nearly 44 cents per 10,000 square feet for each cleaning, or a little over 38 cents not including the flushing. Machine cleaning was done by contract at that time for 35 cents per 10,000 square feet each sweeping, but this figure was reduced later to 19 cents and still later to 16 or 17 cents, not including flushing. It will be seen that the cost for each cleaning will not be appreciably increased if streets are not swept more than two or three times a week, provided the schedule is so arranged as to keep all the men and teams busy every day.

In vol. xxxi, p. 374, is an article on methods and cost of street cleaning which asserts that the author's observation is that cleaning by machine costs 82½ cents per 10,000 square feet, while cleaning by hand costs 27 cents and by flushing costs 35 cents. This in the face of the fact that many contracts have been let for machine sweeping for about one-fifth the cost above stated, and that even if the carting must be added to this latter cost it will still be scarcely more than one-fourth his figure. However, there is great variation in cost and on p. 437 of the same volume will be found a statement of cost of street cleaning in Cleveland by day labor which gives 99 cents per 10,000 square feet as the cost by machine sweepers and pick-up gangs, 47 cents by flushers and pick-up gangs, and 22 cents for "White Wings" or hand cleaning.

Some deductions from U. S. census reports are given in vol. xxx, p. 280. The cost varies widely in the cities of over 100,000 population. If anomalously small results in Kansas City and large results in Baltimore and St. Louis are omitted, the cost ranges from 19 cents per 10,000 square feet in Allegheny, Pa., to $1.71 in Providence, R. I. The average is 59 cents and Indianapolis reports 33 1-3 cents. Other tabular statements of cost will be found in vol. xxii, p. 207, and vol. xviii, p. 200.

In vol. xxxiii, p. 260, is an abstract from a report of street cleaning in Washington, D. C., which estimates the fair prices for hand cleaning to be 22.8 cents per 10,000 square feet, and for machine cleaning 25.3 cents. However, by assigning one man to some 30,000 square feet of street the cost of hand cleaning was kept down to 21 cents for 10,000 square feet, as reported in vol. xxxiv, p. 184.

Hartford, Conn., reports in vol. xxi, p. 41, that the pneumatic sweeper cleans for

25.8 cents per 10,000 square feet, the machine broom preceded by sprinkler for 33.8 cents, and the cost by hand is 55.9 cents.

In Indiana streets are swept by hand in Crawfordsville, Huntington, Lebanon, Lafayette, Ligonier and Martinsville. They are swept by machine in Bedford, Decatur, Kokomo and Richmond. Fort Wayne, Indianapolis, South Bend and Terre Haute use both hand and machine methods. Indianapolis, New Albany and Richmond use flushing methods also.

The latest book on the subject is Soper's "Modern Methods of Street Cleaning" ($3) which describes the methods in use in large foreign cities and in New York.

The State Board of Health of Ohio is making a study of street cleaning and garbage and refuse disposal and will report its findings from time to time, including methods and cost as well as the sanitary questions.

Garbage Collection in Small City.

I should like to get a little information on the collection of garbage and ashes in a small town, where the work has, of necessity, to be done with one man with a horse and cart and that one man the only fellow who is not afraid to tackle the dirty job, and usually he is fit for nothing else. Can it be put on a plane to induce better handling by more responsible men where the funds for that purpose are necessarily limited?

H., Mayor, ———, Ohio.

As stated in a brief article on this subject in MUNICIPAL ENGINEERING, vol. xxxvii, p. 36, little has been done in reducing the methods of garbage collection and disposal to standards in small cities. The article contains references to good articles in previous volumes, for the subject has been discussed frequently. The series of articles on English methods of "Town Scavenging and Refuse Disposal" which is now in progress will give some valuable pointers. So will the other articles which appear in this and following numbers.

The point to emphasize is that good work can not be expected unless the proper compensation is given. The small city requires so small a force and it is so difficult to bring the citizens to proper standards of preparation of material for removal that it is not easy to find a competent man who will be willing to do the work.

A new garbage crematory suitable for small cities is described in the January number, vol. xxxviii, p. 63. This need be operated only when there is enough garbage on hand to keep it busy a few hours, and if located and designed so that there will be no nuisance from the storage of garbage can be used by the smallest towns.

One suggestion is that the city council or town board require every householder to possess himself of two garbage cans, with covers, of prescribed size and design. One of these will be carried away by the garbage collector and taken to the destructor plant. When emptied it will be carried back and the filled can taken away in its place. In a small city or town this plan should work well. It would reduce the objectionable features of garbage collection to a minimum and would provide a storage for the garbage during the hours it must wait for the whole collection to be made and the destructor started. The labor of cleaning and returning the cans would be well repaid by these advantages.

The principal difficulty would be to educate the people to the necessities of the case and to require the supply of the cans and their proper use. This can be done by judicious action of the Board of Health.

With the destructor it would be possible to carry away in the same receptacle all the waste of the houses, garbage, ashes and combustible refuse, and, while there would be considerable variations, the condition of the collections as regards moisture would generally be favorable to ready destruction.

Will our readers add their contributions to the discussion of this subject? It needs far more attention than it has heretofore received, especially in the smaller places. As shown in Mr. Morse's paper before the American Society of Municipal Improvements the larger cities have made material advances in recent years.

Apparatus for Testing Cement.

Will you kindly tell me where I can procure a Vicat needle, LeChatelier's apparatus for testing for specific gravity and sieves Nos. 100 and 200?

C. A. M., ———, Wash.

Names of manufacturers of such apparatus will be found in the "Business Directory" published in eoch number of MUNICIPAL ENGINEERING under the headings "Cement Testing Machinery" and "Testing Machinery."

Relative Cost of Municipal Work Done by Day Labor and By Contract—A Correction.

The writer's attention has been drawn to a statement made on page 83 of the February issue of the MUNICIPAL ENGINEERING under the caption "Statistics concerning the day laborer forces of the sewer departments of various cities," the same being a part of an article by Harrison P. Eddy of Boston, entitled "Relative Cost of Municipal Work Done by Day Labor and by Contract." In the column headed "Saturday Half Holidays" he gives Holyoke as allowing the holiday. This statement is an error or misconception of facts. Holyoke does not allow its laborers a half holiday on Saturday with pay. In the winter time the men work Saturday afternoons the same as any other afternoon; in the summer time the men do not work on Saturday afternoons, but they work forty-eight hours during the week, and the time is so made up that they stop work at 12 or 12:30 o'clock

Saturday noons. This arrangement is allowed by the Massachusetts state laws.

The writer is of the opinion that nearly all of the information contained in the article was gathered in late 1907 or early 1908 and the conditions existing at that time may not have been the same as exist today.

Had the reference regarding the pay for Saturday half holiday been made which is made in the case of some other cities the table in question would have been nearer correct.

I should like to inquire the meaning of the heading of the two columns, the first reading "Rate of Pay Nominal (Per Hour) Cents" and the next column reading "Rate of Pay Actual (Per Hour) Cents."

OSCAR C. TERRY,
Asst. Clerk, Board of Public Works,
Holyoke, Mass.

The table referred to was taken by Mr. Eddy from a table in the report of Metcalf and Eddy to the Boston Finance Commission, and the latter table is in part correct as it has a notation to the effect that Holyoke laborers work 48 hours a week, which time is so distributed that they have a Saturday half-holiday, but is incorrect in that it does not distinguish between winter and summer. In making a transcript for the article in the February number of MUNICIPAL ENGINEERING this notation seems to have been omitted, as it does not appear in the blue print of the table used as copy for the article.

The fourth column of Table 5 gives the quoted rate of pay, being the daily pay divided by the nominal length of the day in hours, given in the third column. This is termed the nominal rate of pay. The actual rate of pay, given in the fifth column is obtained by dividing the pay for a week by the number of hours of actual labor, after allowance has been made for half-holidays or other customs whereby laborers are paid for time when they are not actually at work. It will be observed that only those cities named in the table which allow Saturday half-holidays with pay show any differences between the figures in the two columns.

A communication from Mr. Terry in the department "From Workers in the Field" gives further details about the handling of the labor question in Holyoke.

Paints and Waterproofing for Concrete.

We would like to get hold of a paint for painting cement floors; also a water proofing to use in reservoirs that can be applied with a brush while the walls are damp. Can you give us reference to any firms handling this class of goods that are strictly all right?

A., Lincoln, Neb.

Can our readers give any information on this line? With reference to the floor paint there should be more information regarding the purpose of the paint and the use to which the floor is to be put. The writer knows of no waterproofing which can be successfully used on resevoir walls in the manner described.

Ordinance Governing Census of City.

Can you supply a form of a proper ordinance providing for taking the census of a city of the fourth class for the purpose of organizing as a city of the third class?

R. H. D., ———, Mo.

Can any of our Missouri readers supply the information desired? This seems to be a question peculiar to that state.

A brief sketch of the terms of such an ordinance will be found in MUNICIPAL ENGINEERING, vol. xxxvi, p. 110.

Examinations for City Engineer.

I am advised that you have from time to time published lists of questions presented to applicants for position as city engineer. I would like to see questions submitted to engineers for cities of population from 10,000 to 30,000.

R. A. W., Batavia, N. Y.

Unfortunately there is nowhere in this country any provision for the examination of candidates for city engineer in cities of the size mentioned, so that no such questions have ever been prepared. There is a "Manual of Civil Service Examinations for Engineering Positions in New York City" ($6), but these examinations are confined to subordinate positions in certain departments in that city. The city of Chicago also has such examinations and probably sample sets of questions can be obtained by applying to the Civil Service Commission. There are a few other cities and a few states which have civil service examinations, but they are not numerous in this country and none are known to the writer in cities of 10,000 to 30,000 population. It is not uncommon in Great Britain and Ireland to hold examinations for positions corresponding to that of city engineer, even in cities or boroughs as small as those mentioned, but the duties and the conditions are so different that such questions would be of little value except as examples of the practice in other countries.

MUNICIPAL ENGINEERING would be more than pleased to see some better method of selecting city engineers, and to have the opportunity to publish questions actually used in the examinations of candidates for such positions.

Oil for Fuel Under Boilers.

Can you inform me through the columns of your valuable magazine where I can obtain reliable information about the use of crude oil for fuel under boilers for power purposes?

Would like to know what style or construction of burner to use, and how boilers now used with coal for fuel can be adapted to oil.

W. C. B., Engineer, ———, Kan.

The principal books on this subject are Booth's "Liquid Fuel and Its Combustion" ($8); North's "Oil Fuel, Its Supply, Composition and Application" ($1.75); and Lewes' "Liquid and Gaseous Fuels" ($2).

Boyd's "Petroleum, Its Development

and Uses" ($1) and Phillips' "Fuels, Solid, Liquid and Gaseous" (80 cents) may contain something of value in this connection.

English books on the subject are Hodgett's "Liquid Fuel" ($2.50); Clark and Williams' "Fuel" ($1.50); and Mills and Rowan's "Fuel and Its Applications" ($5).

Where to Take an Examination.

Will you please let me know where would be the best place to write to find out where I could undergo an examination for inspector of stone mason work?

F. M., Pawling, N. Y.

For service in New York City address the Municipal Civil Service Commission, 299 Broadway, New York.

For service with New York State address the New York State Civil Service Commission, Albany, N. Y.

For service with the United States address the United States Civil Service Commission, Washington, D. C.

For service with any city having civil service examinations address the mayor with the request that he refer it to the proper department.

Plans for Municipal Buildings.

Will you kindly furnish me with the names of architects who issue books of plans for city halls and churches.

A., ———, N. D.

The only books of plans for city buildings and churches known to the writer are Crane's "English Country Churches" ($10 in portfolio) and "Church Building" ($2.50); Clinch's "Old English Churches" ($2.60); Kidder's "Churches and Chapels" ($3); Kramer's "The What, How and Why of Church Building" (75 cents); Valk's "Modern Church Edifice and Its Plan" ($1); Bicknell's "Public Buildings" ($2.50); Palliser's "Court Houses, Village, Town and City Halls, Etc." ($2); Keith's "Architectural Studies, Churches" ($2). There are also portfolios and books of early churches and cathedrals.

Reference may be made to the "Business Directory" under the heading "Architects," published in each number of MUNICIPAL ENGINEERING for names of men who will make plans for such buildings.

Can our readers refer us to other publications of the desired nature?

Officers of State Municipal Leagues.

I am desirous of securing copies of constitutions and by-laws of Municipal Leagues or Mayors' Associations of one or more States, also copies of proceedings of their conventions in full. Can you advise where I can secure?

P. BENTZ, Acting Secretary,
State League of Municipalities of Utah.

Address the following officers of such organizations for the desired information and documents:

F. C. Highsmith, Mineral Wells, president of the Association of Texas Mayors.

Harry L. Lusk, New Castle, Pa., for the League of Cities of the Third Class of Pennsylvania.

John MacVicar, Des Moines, Ia., secretary of the League of American Municipalities.

Mayor of LaSalle for Illinois Mayors' Association.

Mayor of Atlantic City, N. J., for League of New Jersey Seashore Municipalities.

Frank G. Pierce, Marshalltown, secretary of the League of Iowa Municipalities.

C. W. Merrill, Richmond, secretary of Municipal League of Indiana.

Lee Combs, Valley City, secretary Municipal League of North Dakota.

Rhodes Brown, Columbus, president of League of Georgia Municipalities.

Lawton F. Hemans, Mason, president of League of Michigan Municipalities.

A. C. Crowder, Mississippi League of Municipalities.

Adolph Roeder, Orange, president of New Jersey State Civic Federation.

W. M. Teague, Montgomery, for Municipal League of Alabama.

Books on Glass Making.

Could you inform me where I could obtain a book on the manufacture and more especially the annealing of glass?

T. J. B., Oroville, Cal.

Rosenhain's "Glass Manufacture" ($2) is a hand-book on the subject. Powell, Chance and Harris's "Principles of Glass Making" ($1) is an English hand-book. "Recipes for Flint Glass Making" ($4.50) may be of interest.

Books for City Attorneys—Who Pays Expense of Quarantine?

What single work do you consider best guide for town attorney? Will you please give me your opinion on the following. It became necessary a short time ago for the local board of health to quarantine several houses in our town to prevent the spread of smallpox. Many of those quarantined were laboring men, dependent upon their labor entirely for their and their families' support. When quarantined they were deprived of their support and became dependent. Has the town board a right under present law to furnish food, board, fuel, or any other necessary commodities for the support of the parties quarantined, or must the township trustee take care of the parties?

H., City Attorney, ———, Ind.

The best work for city attorneys, especially in Indiana, is Thornton on Cities and Towns, which was prepared by an Indiana lawyer, and so gives an emphasis to Indiana conditions. Other good books are Dillon on Municipal Corporations, 2 volumes, and Elliott on Municipal Corporations, a small book.

Sec. 7, of chap. 144 of the Laws of 1909, Indiana, seems to make it the duty of the town board acting as a board of health to pay all the expenses of a quarantine, and the subsistence in every way of those quarantined, if they are prevented from pursuing their occupations is evidently one of the expenses of the quarantine.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Filtering Intake for Water Supply from River.

In relation to "Filtering Intake for Water Supply from River" by A. S., page 112, February issue. The plan proposed, if adopted, will not be a success. The area proposed is not sufficient to give the required amount of water, and if they try back-flushing with 200 pounds of water pressure, they will certainly clean everything.

The increase in suction lift due to this method of getting water will prevent them from getting a sufficient supply during the low water season and if they mix the raw river water with the infiltered water they will get a combination that will give them trouble.

The results obtained from an infiltering system, when properly installed, are superior to any other method of purification in low cost of installation and operation and high efficiency, but the designer must be familiar with the conditions, or the result will be a failure, as indicated by past experience.

We have in use a method similar to the one described which was installed under patents granted L. E. Smith of Charleston, W. Va.

ASA WILLIAMS,
Chief Engineer,
Owensboro, Ky., Water Works Co.

The above letter was submitted to A. S., who responds as follows:

I thank you very much for your attention in regard to arriving at proper decision to install correct filters here and to give me Mr. Williams's opinion. Mr. Martin, former superintendent of Owensboro water works, an intimate friend of mine, has been in correspondence with me since some time about this question, and he too advises large filter area, larger distance from shell to shell. But they and all others who put out natural filters never excavated river to create proper material for the shells to draw from. I claim that 3 feet of gravel at the bottom of shells, then 5 feet of sand and 3 feet more gravel on top even with river bottom will filter water both ways, from top gravel stratum as well as from bottom gravel stratum, making it a natural as well as artificial filter body.

Regarding the flushing and exciting the filter gravel-sand body, it never was intended to open an 18-inch valve under 200 pounds pressure wide open and make trouble. The way I am flushing now and for twenty-eight years, I open an 8-inch flushing valve in pump well and let her go —through strainer openings—but in the filter-suction only an opening of valve gate not over 4-inch or one-half of 8-inch diameter would be used for flushing purposes, and the water, by the time it would rush through 450 feet of 18-inch pipe and then divide itself in ten shells, would not be able to make much trouble, would it? So there need be no fear as to that.

Now, then, if I have very ample filter area and a surplus, the filtered water never can be lower in suction-filter line than the river level, hence no use running old suction. But if I had to do so, from some cause or necessity, I can flush every foot of fourteen miles of main, when filtered water is again pumped. And before pumping filtered water again, after using raw water, I can empty the basins completely without trouble, flush out raw water at eight dead-end flushing stations which I put in to blow out mud. By 1911 I will have every iota of investigation sifted.

By the way, when the Ohio river is extremely low, to make 25-foot lift from low water to discharge valves of pumps, the water then is hard, all spring water, clear as crystal, and the filtered water during the year must be the same hard water, so how could the combination injure the quality? I am sure of this, have watched it for years; at that time both waters will be alike, and if this low water quality ever had made a bad combination heretofore, mixing with rising soft water when rain comes, it would have been found injurious in twenty-eight years. The hard water every year must mix with the soft water when river rises after rains.

A. S., ——, Ky.

Asphalt Repairs in Marion, Ind., in 1909.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I herewith send data on our asphalt repair work for the season of 1909. While not quite satisfied with the showing made, it may be of interest to those having this kind of work to do.

For data on plant equipment I would refer you to former data in MUNICIPAL ENGINEERING, vol. xxxvi, p. 182.

Before beginning 1909 work I had a new bottom put in the Hooke pan, also enlarging same, and instead of turning out 14 2-3 cu. ft. of loose mixture, as in season 1908, we turned out 16 5-6 cu. ft. of loose mixture per batch. This should have increased our output as well as decreasing labor expense, but instead of using the "Acme" asphalt (as in season 1908) we used a different brand of cement which took about 25 per cent. more asphalt for the same amount of mixture, not only adding to the material expense, but it took quite considerable longer time to mix a batch than had we used the "Acme" asphalt.

Total cost of labor and material, $1,486.07.

You will observe that we used stone dust as a filler, whereas in 1908 we used Portland cement as a filler. This should reduce material expense. We used Portland cement as top covering only. You will observe that our fuel did not cost as much as in 1908, yet, owing to the longer time required in mixing a batch, it took more fuel per batch. The same number of men were employed, there being but one new man as an exchange from the gang of 1908. The men were not as energetic in trying to push the work as they were in 1908, which caused the labor expense to increase somewhat. Our work consisted of smaller patches in general than in season of 1908. This caused the labor expense to increase, as when many small patches were made in succession the gang at the plant would be compelled to hold back their work waiting on the men on the street to prepare places to receive material. The accompanying table gives the results in detail.

T. E. PETRIE,
City Engineer and Street Supt.,
Marion, Ind.

This table includes entire season's work.

Total cost of asphalt plant, $625.

Depreciation on plant at 10 per cent. per annum, $62.50.

Interest on plant investment at 6 per cent. per annum, $37.38, or $1.15 per day.

Cost per square yard, average depth 2 inches, $1.024.

Cost per cubic foot, 52½ cents.

Season 1909.	No. Square Yards Laid.	Cost of Labor at 20 and 25 Cents.	Cost of Asphalt Including Freight at $28.714 per Ton.	Cost of Sand at Plant at $0.75 per Cubic Yard.	Cost of Cement at $1.40 per Barrel.	Cost of Stone Dust Including Freight and Drayage at $3.52 per Ton.	Cost of Fuel at $4.50 per Cord.	Cost of Cartage on 20 Tons Asphalt.	No. of Cubic Feet.
July 26	32.8	$18.07	$10.11	$1.35	$0.12	$0.66	$1.55	$0.12	50.5
27	56.2	21.47	23.59	3.15	0.28	1.54	3.15	0.28	117.8
28	74.0	21.47	23.59	3.15	0.28	1.54	3.15	0.28	117.8
a29	10.8	16.56	16.85	2.25	0.20	1.10	2.25	0.20	84.2
30	53.3	21.47	23.59	3.15	0.28	1.54	3.15	0.28	117.8
31	40.0	17.02	16.85	2.25	0.20	1.10	2.25	0.20	84.2
August 2	40.4	18.55	20.22	2.70	0.24	1.32	2.70	0.24	101.0
3	56.8	19.55	20.22	2.70	0.24	1.32	2.70	0.24	101.0
5	67.6	20.01	20.22	2.70	0.24	1.32	2.70	0.24	101.0
4	59.3	20.01	20.22	2.70	0.24	1.32	2.70	0.24	101.0
b6	8.3	15.27	3.37	0.45	0.04	0.22	0.45	0.04	16.8
7	43.2	18.72	16.85	2.25	0.20	1.10	2.25	0.20	84.2
9	49.1	20.15	16.85	2.25	0.20	1.10	2.25	0.20	84.2
10	66.8	20.15	23.59	3.15	0.28	1.54	3.15	0.28	117.8
11	55.7	20.47	20.22	2.70	0.24	1.32	2.70	0.24	101.0
12	40.1	16.38	13.48	1.80	0.16	0.88	1.80	0.16	67.3
14	39.2	16.66	16.85	2.25	0.20	1.10	2.25	0.20	84.2
16	42.2	20.15	16.85	2.25	0.20	1.10	2.25	0.20	84.2
17	56.9	19.65	20.22	2.70	0.24	1.32	2.70	0.24	101.0
18	54.2	19.65	20.22	2.70	0.24	1.32	2.70	0.24	101.0
19	56.9	19.65	20.22	2.70	0.24	1.32	2.70	0.24	101.0
20	56.2	19.65	20.22	2.70	0.24	1.32	2.70	0.24	101.0
c21	29.7	15.22	13.48	1.80	0.16	0.88	1.80	0.16	67.3
b23	16.5	20.02	6.74	0.90	0.08	0.44	0.90	0.08	33.7
24	31.0	19.42	13.48	1.80	0.16	0.88	1.80	0.16	67.3
25	68.1	20.01	16.85	2.25	0.20	1.10	2.25	0.20	84.2
26	23.2	20.01	16.85	2.25	0.20	1.10	2.25	0.20	84.2
27	33.2	16.72	13.48	1.80	0.16	0.88	1.80	0.16	67.3
28	47.9	19.40	16.85	2.25	0.20	1.10	2.25	0.20	84.2
30	39.1	19.61	20.22	2.70	0.24	1.32	2.70	0.24	101.0
31	51.6	19.53	20.22	2.70	0.24	1.32	2.70	0.24	101.0
September .. 1	40.1	20.91	16.85	2.25	0.20	1.10	2.25	0.20	84.2
c2	11.1	7.04	6.74	0.90	0.08	0.44	0.90	0.08	33.7
No. days...33	1,451.5	$618.43	$566.18	75.60	$6.72	$36.96	$75.60	$6.72	2,282.1

a Rained, burned asphalt. b Moved plant. c Finished street.

Preserving the Trees.

That the cities and towns of Pennsylvania are awakening to the importance of shade tree commissions and the proper care of shade trees on the highways of the borough is apparent to any one who keeps in touch with municipal developments in the various cities of the commonwealth. One of the first in Western Pennsylvania

to take up the work of municipal improvement in a systematic manner was the borough of East Washington, a residence suburb adjoining Washington, Pa. Burgess W. P. Warne has been instrumental in having the ordinance passed through the East Washington council which provides for a commission of three men to be known as the shade tree commission, to have full control and care of the shade trees on the thoroughfares of the borough.

This commission has exclusive custody and control, power to plant, set out, remove, protect and care for all trees on the highways. D. W. Myers, J. W. Emery and W. R. McIlvaine, all public-spirited citizens, who will serve without compensation, have been named on the commission and assumed their duties on the first day of February.

The actions taken by the burgess and town council are being met by the approval of the citizens, and it is evident that all possible means will be given to make East Washington one of the prettiest boroughs of homes in that part of the country.

Defects in Springfield Water Works.

In an address before the Chamber of Commerce of Springfield, Ill., Willis J. Spaulding, the superintendent of the water work, gave a strong presentation of the defects in plant and in management which he has found, from which the following extracts are taken. Many cities are laboring under the same difficulties, either through ignorance or negligence, and Mr. Spaulding's strictures will apply to them as well as to Springfield.

The City of Springfield owns a water works system worth perhaps one and one-half million dollars, involving the welfare of 60,000 people and immense real estate values. I am proud that the city owns it. I believe the city ought to own it, and I have faith that the city can manage it. It is my ambition to vindicate and prove that faith.

Early last summer we discovered a large quantity of water from the river was finding its way directly into the galleries. We set to work immediately and repaired this leak. We then had good water for about two weeks, when the supply from the galleries became insufficient, making it necessary to open the emergency intakes, which of course polluted the whole supply, making the water off color and also unwholesome.

As near as could be estimated the supply from the galleries was about one million gallons per day short of requirements. How to make good this shortage was our next problem. We hope to accomplish this by extension of the galleries, which has already been started.

Our income is sufficient to maintain a plant as fine as any in the State, but the funds have not been spent in building up the plant, but are continually diverted from their proper use. Last year about this time $37,000 was diverted from the water fund to the general fund, leaving the department $42,800 in debt. This was illegal, but nevertheless it was done. The pumps and other equipment at the river were not only found to be badly run down, but were in a dangerous condition. We have no storage reservoir to fall back on, but receive our water supply directly from the pumps, so that it is necessary to keep going twenty-four hours every day.

Under such circumstances, ordinary prudence demands that all pumping equipment be in duplicate at least, and that it be the best that money can buy. When I took charge, the city was depending on one pump which had been in continuous service for about ten years. It was known to be badly in need of repairs, but it could not be relieved from duty long enough to permit overhauling. It stopped going one day during the month of July, and the plant was tied up except for one small pump, which was entirely inadequate. The city was in danger from fire, and all water users were in more or less trouble. In an adjoining building was an old pump, installed in 1876, which had not been in use for many years. To avoid another such calamity we took this apart and put it in good repair. We had to do this in direct violation of the orders of the council. This gave us two small pumps available for service which would carry the city in case of emergency. Having these pumps in reserve, we next proceeded to overhaul the big pump.

After taking it apart a remarkable situation was found in one of the steam cylinders. The main valve in this cylinder was placed in position backwards, so that, instead of opening and closing as it was designed to, it remained open continuously, letting the steam pass by without control, making it ineffective and useless. This was adjusted and all worn and weak parts were replaced, and when the work was completed, which required about thirty days, we had a pump that was practically as good as new in every way.

To compare the efficiency of this pump after being repaired with what it had been, we weighed the coal and found that where we formerly burned an average of nineteen tons per day we are now burning about thirteen tons, thus showing a saving of six tons of coal per day, equivalent to $7.80, or about $2,800 per year. However, a portion of this saving is due to the removal of scales from boilers and other boiler room economies.

The new contract made by our present mayor shows a large saving in the purchase price of the coal as compared with what was formerly paid. These savings will reduce our coal bill about $4,500 annually, or about 45 per cent., and I am quite sure that further economies in the use of fuel are possible.

We now have three pumps in good repair, ready for service, with a combined capacity of fifteen million gallons daily.

We spend about $40,000 per year on our

distribution system, which employs anywhere from ten to fifty men laying new mains, keeping services, hydrants and mains in order, etc. We are improving the efficiency in this division by the introduction of modern business methods. I am absolutely certain that the water department can lay its mains, all things considered, as cheap as any responsible contractors will do it, and do the work better, notwithstanding that our men work eight hours, while theirs work nine or ten.

Our average daily pumpage is five million gallons. About one-half million gallons are free and about two millions are wasted, which at the present price we get for water is worth about $250 per day, or nearly $100,000 annually. Thus, of the five million gallons pumped, only two and one-half million gallons are legitimately used and paid for. So, in fact, we have the water supply already, if we could keep it from slipping away from us.

By metering all services this waste water (or most of it) can be saved and turned into pay water, supplying the consumers. As fast as this waste is put to earning revenue it will relieve the present water consumers of a burden they are now carrying, making it possible to make a general reduction in rates of fully one-third.

One objection made to meters is that sewers will become clogged and sanitation bad. I questioned thirty or more metered cities on this point. None of them experiance any such difficulty.

Where meters are in use, each consumer will watch his plumbing and keep it in repair. As an example, a consumer some time ago complained that there was no pressure, and that there had been none for a year or more. On examination we found that nearly all the water from his service was running into the sewer on account of bad plumbing, leaving so little that there was no pressure to be had. Had this service been metered, it would have shown a waste of about $15 per month, or $180 per year, and would have been promptly repaired. The department was receiving about $12 per year, showing a loss of $168.

If our present wasteful methods are still to be pursued, large development projects should be started at once. The mains from the works to the city are inadequate, resulting in a loss of pressure which is becoming serious. We are sometimes unable to deliver water to the third floor of ordinary buildings. At least one large pump must be added and provisions must be made for a large increase in the supply from the galleries or other source. This means an expenditure of from two to three hundred thousand dollars. For the water department to enlarge its plant and increase supplies, without conserving what it already has, is misusing good money by adding waste to waste. By adoption of meters, we can actually reduce the daily pumpage in the face of an increasing population, and put off the greater part of the investment referred to until Springfield has passed 100,000 in population.

I now wish to call your attention to some gross inequalities in the rates charged for water. Our rates are based on quantity consumed, beginning at 25 cents per 1,000 gallons to the small consumer, and grading down to 6 cents per 1,000 gallons to the largest consumer. Thus the small consumer pays 400 per cent. more than the large consumer.

It is common in selling goods to make a price reduction in proportion to quantity. However, such discounts rarely exceed 50 per cent., except where prices are arbitrarily fixed by public service corporations, or where monopoly is unrestrained. When one consumer pays 6 cents and the other pays 25 cents for 1,000 gallons of water, the idea would naturally suggest itself that the department must be either losing money at 6 cents or making an exorbitant profit at 25 cents. Both are true.

It costs at least 8¼ cents per 1,000 gallons to meet fixed charges and other expenses of the water department, or practically 2¼ cents more than the present minimum. At the same time, 25 cents per 1,000 is in most cases unfairly high, and is made necessary because some consumers pay too little.

Through our water rates, as at present applied, we are losing about $5,000 per year on a few large consumers (eleven in all) and are charging the small consumers enough extra to make good the loss. That is to say, we are arbitrarily taking that amount of money from one class of customers and giving it to another class.

It will be argued that most of the water works expense consists in fixed charges, and therefore it is an advantage to the department to sell water to some consumers at a price that will cover a portion of these fixed charges even though too low to cover all. This argument can hold good only where it can be shown either that we have the water in surplus, that any higher price would drive away consumers, or that it would discourage industry. Now, we have no surplus of water available at the present time.

Eight cents per 1,000 gallons is not a high price for water, and will not lose the department any business. It will not discourage factories, because none of them get the 6-cent rate; most of the factories pay double that amount. Those who regularly get the 6-cent rate, or a rate under 8 cents per 1,000 gallons, are five steam railway companies, the Utilities Company, the State capitol, two ice plants, the brewery and one hotel. I do not think any of these would consider themselves as infant industries, which the other water consumers are called upon to assist through charity to the extent of $5,000 per year.

While it is true there are some cities where the minimum charge is 6 cents or

even less, the rate in these cities may be sufficient on account of the cost of production being less. In 375 cities the average minimum is 9.2 cents per 1,000 gallons. In 150 cities, nearly the size of Springfield, and larger, the average minimum is 8.28 cents. These cities have not been selected, but are taken at random. In Chicago the rate was recently raised from 5 to 7 cents because it was found the water department was losing money. The minimum at St. Louis is 8 cents; Minneapolis, 8 cents; Cincinnati, 10 cents; Rochester, N. Y., 14 cents; New York City, 13.3 cents; Boston, 10.6 cents. In 1902 Daniel W. Mead, acting as consulting engineer, advised that our lowest meter rate should not be less than 8 cents per 1,000 gallons, as conditions here would not warrant it.

I believe that the minimum rate should be made 8 cents instead of 6 cents, and that a sweeping reduction of 10 per cent. should be made on all meter rates, conditioned on the bills being paid on or before the 20th of the month in which they are due, but the net sum received by the department after deducting the 10 per cent. should in no case be les sthan 8 cents per 1,000 gallons.

The Engineer as Municipal Reformer.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The value of the engineer as a municipal reformer is getting a somewhat amusing, though also an instructive illustration at the hands of the new mayor of Boston. Mayor Fitzgerald captured the administration of the "reformed" city charter from the reformers, and he now takes an unusual course of action by by putting in force one of the recommendations of the late Finance Commission, which he himself appointed two years ago, and of whose criticism he was the most conspicuous target. Metcalf and Eddy, consulting engineers to the Finance Commission, in one of their many reports took up the waste of water by the city departments, which were not charged for their use of water. Mayor Fitzgerald, in his order just issued, quotes their figures as to the waste, and the resulting deficit to the Water Department, and requires each department hereafter to pay for the water it uses. Metcalf and Eddy estimated that the actual waste of water reached an annual total of $25,000, while the loss of revenue to the Water Department was set at over $300,000. Mayor Fitzgerald quotes the engineers' figures and adopts their recommendation. The value of expert investigation of city affairs could hardly be better demonstrated. S., Boston, Mass.

Cost of Operating San Francisco's Asphalt Plant.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Enclosed you will find cost of operating our municipal asphalt plant from March, 1909, the date it began operations, to January 1, 1910.

LEONARD S. LEARY, Chief Bookkeeper
of Board of Public Works,
San Francisco, Cal.

Similar work done on Market street by private contract cost 16½ cents per square foot. The saving made by the plant is therefore $97,558 during the time covered by the report.

COST OF OPERATING SAN FRANCISCO'S MUNICIPAL ASPHALT PLANT FROM MARCH 1, 1909, TO JANUARY 1, 1910.

1909.	Cubic feet Binder	Cubic feet wearing surface	Cost of Material in binder	Cost of Material in wearing surface	Total cost of Material	Cost of labor at Plant	Expense at Plant	Total Cost of Material labor at Plant	Total cost labor, teaming etc on street.	Total Cost of Laying Pavement	Square Feet of Pavement Laid	Cost per square foot laid
Mch.	11702	9054	$1755 30	$2878 20	$ 4633 50	$1367 55		$6001 05	$3241 62	$9242 67	59436	0.1552
Apl.	20234	20620	3065 18	5959 30	9024 48	1643 51	$ 336 00	11003 99	5451 63	16455.62	143473	0.1147
May	17912	26712	2686 88	7270 56	9957 44	1942 35	584 69	12484 48	6327 22	18811 70	197861	0.0951
June.	23528	25428	3528 80	6857 28	10386 08	2089 76	1041 21	13517 05	5524 88	19041 93	192926	0.0987
July.	28088	26096	3847 29	7349 44	11196 73	2288.86	775 31	14260 90	6636 76	20897.66	191884	0.1089
Aug.	25288	26848	3463 82	6980 48	10444 30	2309 41	1407 60	14161 31	7138 43	21299 74	205413	0 1037
Sept	24486	24992	3354 53	6494 87	9849 40	1980 27	1335 58	13165 25	6688 45	19853 70	200400	0.0991
Oct	24720	24532	3386 67	6801 16	10187 83	2072 85	1865 31	14125 99	7058 22	21184 21	216597	0 0987
Nov	20760	15648	2844 09	4087 68	6931 77	1955 94	2036 38	10914 09	4879 56	15793.65	126217	0 1243
Dec	16800	15668	2301 59	4076 88	6378 47	1809 36	1581 43	9769 26	4007 31	13776.57	125865	0 1094
	215518	215598	$30234 19	$56755 85	$86990 00	$19459 86	$10955 51	$119403 37	$56954 08	$176357 45	1660072	0 10623

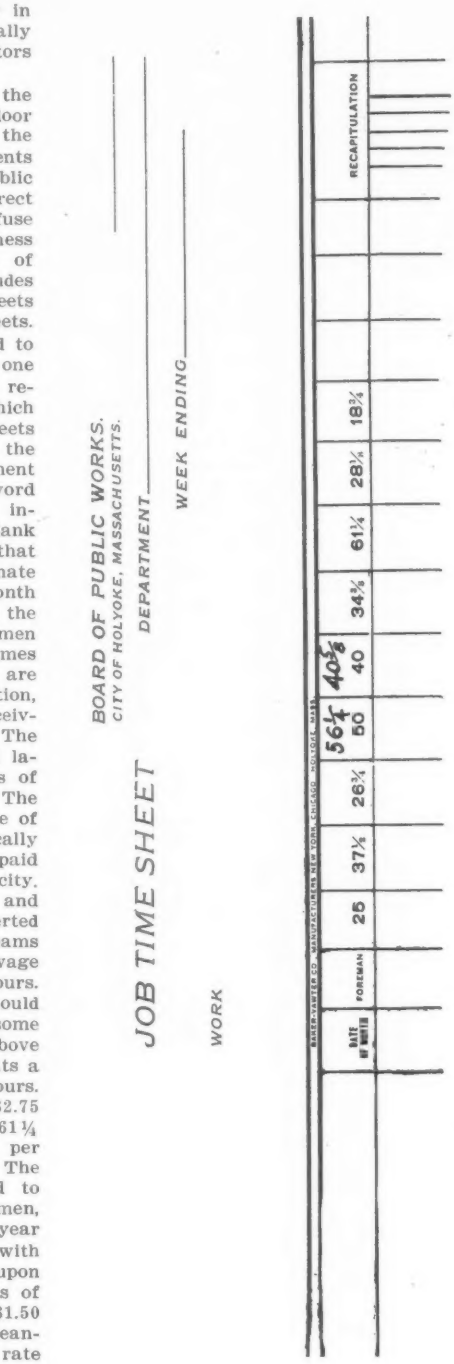
Handling Day Labor in Holyoke, Mass.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The methods used by this city in handling day labor do not differ materially from the methods employed by contractors in so far as the writer is aware.

All of our outdoor work is under the direction of the superintendent of outdoor work, who works directly under the board. He has charge of all departments except water works, parks and public buildings; in other words, he has direct supervision over the removal of refuse and garbage from residences and business blocks, the care and maintenance of streets, ways and bridges, which includes the building of sidewalks, repairing streets and bridges, and the sprinkling of streets.

The charge for the work is returned to this office on sheets similar to the one enclosed. The time for the men is returned on a time sheet, a copy of which is enclosed herewith. The job time sheets are numbered on the black line in the upper right-hand corner; the department is stamped on the line after the word "Department." The week ending is inserted on the proper line, and the blank lines after the word "work" are so that the timekeeper can properly designate what the work is. The day of the month is inserted in the proper column and the name of the foreman for whom the men work. On the job time sheets no names are inserted. The blackface figures are the rates per hour paid. For illustration, the column headed 25 is for men receiving 25 cents an hour or $2 per day. The 37½ cents column is used for skilled laborers, for masons' tenders, engineers of rollers and some other workmen. The column 26¾ represents the wage scale of $2.14 a day for eight hours, practically $15 per week. This rate of wages is paid to the drivers of teams owned by the city. The 50-cent column is now obsolete and should read 56¼, which I have inserted above this column, and is used for teams hired by the city. This represents a wage scale of $4.50 per day of eight hours. The 40-cent rate is obsolete and should read 40⅝, representing the rate paid some of the foremen. I have noted this above the figures on the sheet; this represents a wage scale of $.25 per day of eight hours. The 34⅜ represents a wage scale of $2.75 a day and is paid to carpenters. The 61¼ column represents the wages paid per hour to bricklayers and masons. The 28⅛ column is $2.25 per day paid to some of the skilled and permanent men, men whom we keep at work the year around. These men being familiar with the various departments, are called upon in storms to care for certain sections of the city. The rate 18¾ represents $1.50 a day paid to women scrubbers or cleaners in our public buildings; also this rate is paid occasionally for single horses hired by the board without drivers. We have one or two men whom we pay 31¼ cents



or $2.50 a day; these are practical, skilled workmen. The rate of wages in Holyoke, as paid by the city of Holyoke, is about the same as is paid by contractors or other large employers of labor.

The total number of hours which each foreman has on a particular job on any particular day is simply entered in the proper column, and the sheet may contain the returns on that job from several foremen, so that at the end of the week the total of the columns represents the total number of hours of labor that has been expended upon any job during that week by all of the workmen in our employ.

I should be very glad to answer more in detail any questions that you might like to ask, but this in brief covers the general outline of the way that our time is made out.

OSCAR C. FERRY.
Assistant Clerk Board of Public Works,
Holyoke, Mass.

Concrete Boundary Monuments.

Concrete is now generally recognized as a cheap and eminently satisfactory substitute for granite for use as boundary monuments. The following details of construction and cost are therefore of interest. They are drawn from the report of Leonard Metcalf, civil engineer, Boston, to Kennebec Water District, Waterville, Me., and relate to an exceptionally fine piece of work done under Mr. Metcalf's direction in connection with the China Lake water supply.

These monuments were built upon the ground in post holes 5 feet or more in depth and in forms, either flush with the ground in meadows and pastures, or about 1 foot above the surface of the ground along fence and property lines. The monuments were of the following general form: Below the ground, 8 inches in diameter, 5 feet in depth, with the base flared out to from 4 to 6 inches greater diameter; above the surface of the ground or at the top of the post, 6 inches square for a length of 6 or 16 inches, according as the monuments were built flush with or above the surface. In the four corners of the square top and extending to the bottom of the post were bedded bars of ¼-inch steel, bent in U form across the top of the post. In the top of the post was bedded a small iron casting with expanded bottom bearing the letters K. W. D. and the number of the monument, as, for instance, K. W. D. 95.

The concrete of which these monuments were made was mixed on the ground in the proportion of one part of Portland cement to two parts of sand to four parts of gravel or broken stone of approximately ½-inch diameter.

The cost of these monuments was considerably less than it would have been for granite monuments, and it is believed that they will prove even more satisfactory, since it seems probable that there will be less danger of heaving by frost; time alone, however, can determine whether this is the fact. The total cost of the monuments in final position averaged about $4.30 each, including therein the cost of all maerials, supplies and forms, and all teaming, labor and supervision.

COST OF MONUMENTS.

	No. Built.	Cost per Month.	Average.
September ..	52	$211.85	$4.07
October	36	160.25	4.45
November ..	15	65.25	4.35
Total	103	$437.35	$4.25

This includes $1 per day for 48 days for district horse, but does not include cost of forms, which amounted to between $4 and $5, making the total average cost per monument (in place) $4.30.

MUNICIPAL MATTERS IN COURT

Higher Courts—Water Company Liable for Fire Loss—Foreign Drainage Outlet

Decisions of the Higher Courts of Interest to Municipalities.

PREPARED BY JOSEPH W. KENNEY, ATTORNEY, INDIANAPOLIS, IND.

Recovery of Money Illegally Paid to Councilman—Suit by Taxpayer.—Where there is no statute providing for recovering back money illegally paid to councilmen as compensation, a suit in equity may be prosecuted for that purpose by any taxpayer on behalf of the municipality or on behalf of himself and other taxpayers, and in such suit all the councilmen so illegally receiving money may be joined in one action to prevent a multiplicity of suits.—Walker v. Village of Dillondale, 30 Ohio Cir. Ct. R. 623.

Municipal Bond Issue in Excess of Constitutional Limitation—Effect of Contrary Recital.—If municipal bonds disclose upon their face an issue in excess of the constitutional limitation, a purchaser cannot rely upon a recital to the contrary. * * * The purchaser of such municipal bonds is bound to ascertain at his peril from the public records the amount of such valuation.—St. Lawrence Tp. v. Furman (U. S. C. C. A., S. D.), 171 F. 400.

City Not Liable for Negligence of Independent Contractor.—A municipal corporation is not responsible for the negligence of an independent contractor, where it appears that the work about which said independent contractor was employed was not intrinsically dangerous, and where such work was not such as a municipal corporation was under a primary and inalienable duty to perform by itself.—Fields v. Johnson City, 143 Ill. App. 485; Mathis v. Same, Id.; Follis v. Same, Id.

Vessel Damaged by Swinging Bridge—Liability of City.—The city of Chicago is liable to the owner of a vessel for damages caused thereto by the negligent act of an employe of such city in control of a bridge in swinging such bridge against such vessel.—(1908) Lehigh Valley Trans. Co. v. City of Chicago, 141 Ill. App. 618; judgment affirmed (1909), 86 N. E. 1093.

Declaration by Ordinance That Building Is Nuisance Is Not Conducive.—The mere declaration of a town council by ordinance that a building is a nuisance will not make it so, unless it is such in fact.—Town of Lonoke v. Chicago, R. I. & P. R. Co. (Ark.), 123 S. W. 395.

Ordinances Against Acts Not Wrongful Per Se.—Municipalities cannot unduly interfere with the liberty of citizens by ordinances against acts not unlawful or wrongful per se.—City of Carthage v. Block (Mo. App.), 123 S. W. 483.

Tax Levy for Specific Purpose Does Not Exhaust City's Power in the Premises.—The levy and collection of taxes by the city of New Orleans to satisfy outstanding debt of metropolitan police board held not to exhaust the city's power in the premises.—State of Louisiana v. City of New Orleans, 30 Sup. Ct. R. 40.

Law Authorizing Proceedings in Circuit Court to Have Land Excluded from City Limit Held Constitutional.—The statutes of South Dakota (Pol. Code Sec. 1511) providing that on failure of a city council to exclude land from the city limits upon the owner's petition, such owners may file a petition in the circuit court, and section 1512, authorizing the court to order that the petition be granted, if upon hearing it appears it should be granted, are not unconstitutional as investing the circuit court with legislative powers.—Wickheur v. City of Alexandria (S. D.), 122 N. W. 597.

Damage to Building by Construction of Sewer in Adjoining Alley.—The damage to a four-story brick building and its contents by the laying by the city of St. Louis of a sewer in an adjoining alley below the plane of the foundation of the building, after the owner knew in time to protect the building that the sewer was to be laid and might cause his building to settle, whereby the lot was not caused to settle, but the building was cracked and its contents injured, is, according to the decisions of the Supreme Court of Missouri, damnum absque injuria (damage without injury), and the owner is not entitled to compensation under Const. Mo. art. 2, sec. 21 (Ann. St. 1906, p. 148), providing that private property shall not be taken or damaged for public use without just compensation.—Johnson v. City of St. Louis (U. S. C. C. A. Mo.), 172 F. 31.

Tax Levied upon Street Cars as License Fee.—The city of Pittsburg brought an action against the Pittsburg Railways Co. upon a claim of $94,200, which indebtedness arose by virtue of two city ordinances. The first ordinance operative from and after February 1, 1894, provided that "all street passenger railway compa-

nies shall pay into the city treasury $60 per annum for each and every car used on the streets of the city of Pittsburg whose lines are entirely within the city, and $30 for each and every car of those companies whose lines are not entirely within the city, the amount to be paid as a license fee. The second ordinance, operative from February 1, 1907, provided that all street railway companies operating in Pittsburg shall pay into the city treasury $100 per annum for each and every car used on the streets of the city. *Held,* That the city had no authority under the act of March 7, 1901, P. L. 20, to impose a license fee upon the street railway company as a revenue measure, nor would the ordinance be valid as imposing a fee for compensation to the city for police inspection and supervision. The court based its ruling upon the case of Pittsburg Railways Co. v. Pittsburg, 211 Pa. 479.—Pittsburg v. Pittsburg Ry. Co. (Pa. 1909).

Board Walk Patched with Two-Inch Planks Not Unsafe.—A municipal sidewalk is not as a matter of law unsafe so as to come within the meaning of a statute imposing a liability upon the municipality for injuries to pedestrians caused thereby, merely because in making repairs, a patch of two-inch planks was spiked on top of the former planking, so as to leave an abrupt inequality in height of two inches between the portions of the walk. —Kawiecka v. Superior (Wis.), 118 N. W. 192.

Mandamus to Compel Railroad Co. to Open Public Road.—A mandamus to compel railroad to reconstruct and open a public road closed by its tracks must be instituted by the attorney general or the district attorney, and not by the borough on the relation of the burgess.—Bellevue Borough v. Pa. R. R. Co., 18 Dist. Reports 945.

Acceptance of Franchise Granted by City.—In the absence of any statute requiring a different acceptance of a franchise or privilege granted by a cit, a written acceptance thereof subject to the conditions imposed is unnecessary, and the actual enjoyment of the privilege is a sufficient acceptance to create contractual obligations.—City of Superior v. Douglas County Telephone Co. (Ill.), 122 N. W. 1023.

City's Contract with Telephone Company to Maintain Telephones Without Cost in Public Offices.—A contract binding a telephone company operating in a city to maintain telephones in the public offices in the city building and in the public library building, without cost to the city, entered into at a time when there was no statute prohibiting the company from granting the city a different rate for service than general customers, is not invalid because creating an unjust discrimination. . . . Communication by telephone with the public offices of the city renders the service the company offers to its general customers more valuable, and the granting by the city of such a right to the telephone company operates to expedite public business, so that such a right is a legitimate basis for such a contract between the company and the city.—Idem.

Water Company's Contract with City to Furnish Free Water to Public Schools.—The requirement of a contract by a water company with a municipality that free water be furnished public schools, churches, town offices, market houses for city use, and all other town offices, can not as to the public schools be avoided, because such schools are controlled by a corporate body other than the municipality, and no charge upon water furnished can be made for children attending the schools who live outside the municipal limits. . . . Such requirement to furnish free water to public schools does not include water for sprinkling lawns, playgrounds or for bathrooms or bathing pools, but only for drinking purposes, for toilet and water closets.—Henderson Water Co. v. Trustees of Henderson Graded Schools (N. C.), 65 S. E. 927.

City Not Liable for Injury to Prisoner. —A city is not liable for injuries sustained by one while breaking rock on the municipal rock pile to pay a fine, in consequence of a splinter of the hammer, used by another engaged in a like occupation, flying off and striking him in the eye, though the accident was caused by the negligence of its officers.—Jackson v. City of Owingsville (Ky.), 121 S. W. 672.

Defective Construction of Culvert—City's Liability for Resulting Injuries.—The rule that no damage can be recovered from a municipality for injuries resulting from a failure of judgment on the part of the officers of the municipality in constructing a sewer to carry off surface water, does not apply to the construction of a culvert or drain to carry a highway over a natural stream of water.—Metzgar v. Lycoming Tp., 39 Pa. Super. Ct. 602.

Public Improvement in Excess of Estimated Cost—Expenditure Without Proper Notice—Assessment.—Laws of 1903 (p. 231, c. 124), declare that in proceedings for the enforcement of special assessments, where the work has been done which would be properly chargeable on the property assessed, a recovery shall be permitted to the extent of the proper proportion of the value thereof, chargeable on the land, notwithstanding any informalities in the proceedings. *Held,* that where the estimated cost of a public improvement was $6,000 and the city permitted an expenditure therefor of $14,812.50 without proper notice to the property owners, the property was still subject to assessment for its proper proportion of the original estimate.—Rehearing 102 P. 1027 denied.—City of Chehalis v. Cory (Wash.), 104 P. 768.

Bonds—When Included in Determining Indebtedness of a City.—Bonds of a city

to pay the cost of local improvements, which are the absolute and unqualified obligations of the city, and which are issued on its faith and credit alone, and which, when due, are payable directly by it, are debts of the city, within Const., art. 8, sec. 10, though the cost is assessed back more or less on the property benefitted, as the lien on the property can be regarded only as a general asset. . . . Bonds issued under Greater New York charter (Laws 1901, p. 72, c. 466), sec. 187, for purposes other than to meet expenditures under the appropriations for each current year, and made redeemable out of the tax levy for the year next succeeding the year of their issue, under an appropriation therefor by the board of aldermen and the board of estimate and apportionment in the budget for such years, when issued in one year to be redeemed in the following year, may not be included in computing the indebtedness of the city, within Const., art. 8, sec. 10. . . . City bonds held by the sinking funds thereof are not debts within Const., art. 8, sec. 10.—Certified Questions, Fleishmann Realty & Const. Co. v. McClellan, 116 N. Y. S. 1087, 132 App. Div. 913, answered.—Levy v. McClellan, 89 N. E. 569; Meyer v. Same, Id.; Fleishmann Realty & Const. Co. v. Same, Id.

Mode Prescribed in City Charter for Supply of Light Is Exclusive.—The supplying of light by a municipality is a "necessary expense" and is a power necessarily and reasonably implied in its general grant of powers, and can be exercised unless expressly forbidden, but the mode prescribed in the charter is exclusive.—Henderson Water Co. v. Trustees of Henderson Graded Schools (N. C.), 65 S. E. 927.

City's Contract with Individual to Operate Market House Does Not Create a Monopoly.—A contract between a city and individuals for the erection by the latter of a market house, which shall be under the control of the city, and which fixes the minimum rental for stalls therein, and which gives the city an option for the purchase of the property at stated periods, and binds the city to pay a rental equal to the city taxes on the property until the enterprise is on a paying basis, is not invalid as conferring a monopoly on the individuals within Const., art. 1, sec. 31, but is valid within the police power of the city to protect the health.—State v. Perry (N. C.), 65 S. E. 915.

Liability of Water Companies for Fire Loss Due to Inefficient Service.

In a recent paper on water works valuation, Leonard Metcalf, consulting engineer, Boston, points out that a consideration which heretofore probably has had little weight in water works valuation, but which may depreciate properties of this character permanently, is that of the financial liabilities of water companies for loss incurred by fire in which inadequate fire service can be proven. Court decisions have been numerous upon both sides of this question, but the weight of decisions has, before the Greensboro decision, been largely in favor of the water companies, upon the technical ground that, inasmuch as the water consumers were no parties to the contract of the water company to furnish water to the city for fire protection (or, to use a safer word, water for fire service), they could not sue the water company for breach of contract. Judge Brewer, of the Supreme Court, in the appealed Greensboro Water Company decision, however, has taken the view of water-company liability based upon the broad ground of negligence, a decision of far-reaching important to many water companies, suggesting the need of the greatest care in the preparation and wording of fire-service contracts.

Outlet for Drainage Can Be Constructed in Foreign Country.

The Supreme Court of North Dakota reversed the decision of Judge Templeton, January 21, in the injunction proceedings against the drainage commission of McHenry and Bottineau counties, restraining them from constructing a drainage canal which would extend fourteen miles into Canadian territory. Judge Templeton decided in favor of the plaintiff, holding that it was unlawful for the commission to spend money raised by taxation in a foreign country. The Supreme Court reversed this decision, holding that under certain conditions, which existed in the present, the contention of the lower court was not right.

Work on the canal will now be commenced in the spring, to reclaim 25,000 acres of meadow land, which, at the present time is entirely useless, and arrangements have been made with the Canadian government for a proper oulet for the waters.

The gist of the decision is as follows:

Improving a water course after it passes beyond the drainage district for twelve or fourteen miles into foreign territory, for the purpose of making an improvement of the water course in this state efficacious, is not an unreasonable exercise of the power of securing an outlet for drain purposes.

Florida Decision That Water Company Is Responsible for Fire Loss.

The case of Robert Mugge against the Tampa Water Works Company, Tampa, Florida, was tried in the Circuit Court in that city, and the jury returned a verdict of $11,500, with interest, making a total of $15,000 for the plaintiff. The case, which was on trial for eighteen days, created intense interest at Tampa and elsewhere, for, being the first of its kind ever tried in that state, on it depend a number of other suits involving a loss of $500,000 in property at the conflagration of

Ybor City, in March, 1907. In this fire more than thirty buildings were burned, through the failure of the water company, the plaintiffs allege, to supply adequate water protection.

In charging the jury, Judge Wall said:

If you find from evidence that the failure to extinguish the fire was the proximate result of any defect in the appliances or apparatus of the fire department, and not failure of the water works company to furnish the pressure on its mains as called for in its contract, you should find for the defendant. If you believe from the evidence, applying to it the law as given you in these instructions, that the defendant failed to furnish water as called for by its contract with the city, and that, had the defendant complied with its contract about furnishing the water, the fire would have been put out, and by reason of its fault plaintiff's property was destroyed, you should find for the plaintiff. If you find that the company did comply with its contract, or if you find that even if the water had been supplied the building would have been destroyed, you should find for the defendant.

MUNICIPAL PROBLEMS

Fort Worth Charter Service—Passaic Valley Sewerage—New York Water Power—Want New York City Water.

Fort Worth Charter Valid.

A firm of bond buyers of Boston, Mass., raised a question recently as to the validity of the city charter of Fort Worth, Texas, because of alleged irregularities in its passage through the legislature. An opinion filed by Attorney General Lightfoot, February 8, holds, however, that there is no cloud on said charter. The journals of the house show that it was read on three several days as required by the constitution. Mr. Lightfoot finds, furthermore, that when the constitution means a certain vote taken for any purpose shall show a certain fraction of the "members elect" participating therein the constitution specifically so states as in the case of the provision governing the vote to give the emergency clause immediate effect. With regard to suspending the rule requiring bills to be read on three several days, however, there is no reference to "members elect," which leads to the conclusion that four-fifths of a quorum is all that is needed for that purpose.

Other Municipalities Want Some of New York's Water at Cost.

The towns of Westchester county, New York, are moving to secure an amendment to the Catskill water supply law reducing the charge to municipalities along the aqueduct which may take advantage of the privilege to draw from that main. The rate, according to the law, shall be the same as that paid by New York city consumers and thirteen cents a thousand gallons is now being paid. The down-river towns say this "includes all cost due to fixed charges sinking fund maintenance and operation of the distributing system within New York city, as well as the losses due to leakage in said distributing system, in the use of which the municipalities in Westchester could not join."

These towns declare that thirteen cents is an excessive rate ,and the fact is pointed out that the metropolis will profit by the sales of water to the municipalities, as the increased consumption will not be attended with any additional cost to the city. The amendment of the law so that municipalities will pay for water taken from the aqueduct at the same rate the water costs the city of New York down to the point of connection is urged.

The request for a lower rate is generally regarded as reasonable and just.

Passaic Valley Sewerage Commission Decision.

The Passaic Valley Sewerage Commission has begun advertising its intention of introducing in the legislature of New Jersey a bill specifically authorizing the commissioners to sign the agreement reached between them and the government. This would put an end to the long-pending litigation over the postponed sewer, so far as the government is concerned. The notice of intention was to be advertised for one week and the proposed act then presented to the legislature.

State Water Power Development Recommended by New York Commission.

The Water Supply Commission of New York has recommended to the legislature an amendment to the constitution permitting an issue of $20,000,000 state bonds for building storage reservoirs with a view to generating electric power and controlling the water flow of the streams of the state. After thoroughly investigating the question, the commission estimates that 1,500,000 horsepower of water energy is running to waste in the state annually, and that it would have a yearly rental value of $15,000,000 if properly controlled.

The interest charge on the cost of de-

veloping this water power is placed at $3,000,000 a year, leaving an annual revenue to the state of $12,000,000. The commission states that the time has arrived for the state to adopt a plan of water power conservation not only for the purpose of generating electric power but with a view of regulating the flow of our rivers and to make possible the control of floods.

MUNICIPAL AND TECHNICAL LITERATURE

Savannah Street Paving—Knoxville Water Works—Detroit Asphalt Plant —Washington Municipal Accounting—Boston Refuse Disposal—New Publications.

Street Paving in Savannah.

In his annual report J. W. Howard, city engineer of Savannah, Ga., states that 44.9 miles of streets have been paved during the year. The city's paving now aggregates the following:

	SQ. YDS.	COST.
Asphalt	140,814	$362,172.87
Vitrified brick	352,414	539,704.48
Asphalt block	174,285	380,434.03
Chert	14,912	
Cobblestone	123,070	
Granite block	88,568	
Shell	45,505	
Gravel	58,176	
		—493,378.32
Total	996,744	$1,775,689.70

The city has set aside $55,000 for paving new streets and $6,000 for re-surfacing with gravel and shell this year.

Knoxville City Water Works Report.

The sixth annual report of the water commission submitted to the city council of Knoxville, Tenn., recently, was the first report on the operation of that city's municipal venture from September 18, 1909, to December 31, 1909. The report shows at great length and in much detail the number of mains in use, when they were laid, their dimensions, the length of the pipes, and their location. The number of extensions made by the commission from the time of acquiring the plant, is also shown in detail. The summary shows that on December 31 the total mileage of mains was 581,385.3 feet, or 110.11 miles. The total number of hydrants is 385 and of valves 1,195.

Detroit's Municipal Asphalt Plant Report.

During the last year the municipal asphalt plant of Detroit, Mich., has saved that city $53,782.13. This is the best showing made, as yet, because during the last year the work done was fully half as great as the total of the work accomplished during the preceding five years. The plant and the gangs produced and laid during this year 198,559 yards of resurfacing; 20,309 yards of repaving; 35,916 yards of patching. The cost of labor, etc., was lower than the average of the last five years. This year the resurfacing cost 85 cents a yard, the former average being 88 cents; repaving, 80 cents against a former average of 83 cents; patching 93 cents against 94 cents. The cost of the work to the city was $257,152.76. It is estimated that under contract the cost would have been $310,934.94. The gross saving to the city during the last six years has been $146,698.59.

In addition to this 20 cents a yard for maintenance and 10 per cent for depreciation of the plant is reckoned. According to this reckoning, which is made by expert Clarence A. Proctor, the plant, which is worth $46,000, is six-tenths paid for by the work of the department itself.

Improved Municipal Accounting for Washington.

The Commissioners of the District of Columbia presented, in the report recently submitted, the urgency for the adoption of a well-organized and centralized system of accounting control of the finances of the District, together with a thorough analytical system of bookkeeping, in order that the business of the government could be transacted without financial loss and that the results of its business could be expressed accurately and intelligently. In urging a revision along these lines the commissioners have not contemplated the establishment of an intricate and voluminous system of bookkeeping with endless extensions and ramifications. What is desired is in line with that which has already been partially accomplished, namely, revision along practical business lines, the accomplishment of practical results; that there may be centralization instead of decentralization in financial control; that all receipts and disbursements of the District may be handled through the proper officers of the District; and that all ac-

counts relating to the District may be kept in the District auditor's office, so that annually the Commissioners, with full knowledge of all the facts relating to all of the business of the District, may submit to Congress an accurate and comprehensive statement of the business transactions of the District of Columbia.

Boston Report on Collection and Disposal of Refuse.

The second special commission on the collection and disposal of refuse in Boston submitted its report January 31. The document goes into detail regarding the present methods and those which it thinks are better. Some extracts from the report will appear later. The final conclusions, aside from some of strictly local application, are as follows:

The commission recommends the disposal of the city's entire waste by burning in modern incinerators of the so-called English "Destructor" type, operated by forced draft and at a temperature of not less than 1,500 degrees F. Such destructors should be introduced gradually, beginning with the district in which the need is most urgent and extending to other districts of the city as required.

The commission recommends the immediate construction in the Roxbury district of a destructor capable of burning 300 tons of mixed refuse per twenty-four hours. This and all other destructors should be so designed as to be capable of enlargement, with a minimum of interference and expense, as necessity may arise.

The commission further recommends that the contract with the City Refuse Utilization Company, now on a thirty-days' footing, be terminated, with a view to securing more advantageous terms for the city, not necessarily by continuing operations at the present location on Hecht's Wharf.

The plan of combining disposal by incineration, in destructor plants of the type recommended above, with a garbage reduction plant so designed as to prevent the escape of foul odors, might enable the city to dispose of its waste effectually and satisfactorily by contract, at less cost than by the burning of mixed waste in its own destructor plants. The contract plan tentatively outlined to the commission involved both the collection and disposal of all wastes at a cost much less than would be required if the work were done by the city. It has already been pointed out that this plan admits of separating the collection of waste from its disposal, and the commission recommends that if the plan be again presented, either in its original form or as thus modified, the desirability of its adoption be given careful consideration.

In view of the importance of utilizing the surplus power developed by the destructors, it is essential that immediate consideration be given to the question of the most favorable locations for prospective destructor plants, with due regard both to the convenience and general suitability of such locations and to the disposal of power.

The majority of the members of the commision are of the opinion that it would be to the advantage of the city in either cast to do the work by contract and, if a suitable contractor can be found, that it would be better to let the entire work of collection and disposal for the whole city to one contractor.

New Publications.

Curves for Calculating Beams, Channels and Reactions. A manual for engineers, architects, designers, draughtsmen, builders and contractors. By Sidney Diamant, E. E., structural engineer. Cloth, 13 pp., 25 plates. $2 net. McGraw Publishing Co., New York City.

The sets of diagrams given are intended to reduce the labor of computing beams for structural designs. The formulae and assumptions are explained, and the methods of computing readily the effects of changes from the assumptions used. The first set of thirteen diagrams enables one who knows or assumes any two of the three quantities, length of span, width of supported area and size and weight of I- or channel-beam, to determine the third. Each diagram has a different loading per square foot of the supported area, ranging from 80 pounds in the first plate to 500 pounds in the thirteenth. Tables of properties of standard channels and I-beams make selections of beams easy. The last twelve plates enable one knowing the half span and the width of supported area to find directly the beam reactions. The diagrams are simple and clear and should be easily used. Interpolations can be made easily, and at the same time the diagrams are not so close as to be difficult to read or hard on the eyes. Good judgment has been used in this respect.

Sewer Construction. By Prof. Henry N. Ogden, C. E. Cloth, 347 pp., $3. John Wiley & Sons, New York.

Designed as a text-book for his classes in the College of Civil Engineering at Cornell University, the author has, on account of his experience in construction, been able to make as well a very practical book, of value to the young engineer in the field or the engineer attacking his first problem in sewer construction. His earlier book on "Sewer Design" ($2) gives that part of the subject, so that this book can be devoted wholly to the construction end. Special acknowledgment is made of material concerning examples of construction taken from several publications, including MUNICIPAL ENGINEERING, but in the foot-note acknowledgments the credit is given under the title *Paving*, which was dropped from the title of this magazine with the tenth volume, in 1896.

The subjects of the chapters are terra cotta pipe, brick, concrete, concrete and

brick, and reinforced concrete sewers, manholes, catchbasins, siphons, screens, storm water overflows and regulators, bell mouths, foundations, outfall sewers, house connections, surveying, trenching, estimates and costs, specifications and contracts. It will be seen that practically all the subjects are covered. It is not difficult to determine from the methods of treatment of the various chapters which are the result of his own experience, but he has nowhere departed from safe practice and is usually clear in his explanations. Not all engineers will agree with the detail of some of his methods of work, but they will secure good work at reasonable prices.

The last chapter gives a set of specifications which has passed the test of use under severe conditions, but the author shows some really serious faults in some of the clauses. He does not give sufficient warning that the form of the specifications and contract will not suit all conditions, possibly because all his work has been done in one state or in states following the same general methods. Very material modifications will be necessary to fit them for use in some of the states of the Union, not as regards the engineering features, but mainly in the general clauses and those affecting the relations of contractor, employer and engineer.

Staley and Pierson and Folwell are the standard authors on sewer construction, and Ogden may now be added to the list, because, while he does not cover some points quite as satisfactorily, he covers the ground more completely and brings the art of sewer construction down to date.

Report of the Municipal Art Commission for the city of Los Angeles, Cal., to the mayor, city council and board of public works. Charles Mulford Robinson, Rochester, N. Y., and others.

The major part of this well-printed and illustrated report is taken by the well-considered and detailed recommendations of Mr. Robinson. He covers the lighting of the business streets, beautifying of residential streets and river, and proposed union railway station and approaches, administrative center, parks, boulevards and parkways, with illustrations of what has already been done in the city, the natural backgrounds, which add so much to the beauty of whatever may be done, and the successful efforts of other cities.

F. W. Blanchard discusses the suburban roads briefly, City Engineer Homer Hamlin shows what the city is doing and proposes to do with its bridges, and City Clerk Harry J. Lelande describes the Owens river aqueduct now under construction.

ORGANIZATIONS AND INDIVIDUALS

Chicago Cement Show—National Association of Cement Users—Northwestern Cement Products Association—Cement Tile Makers

The Chicago Cement Show.

The great Chicago Cement Show, held February 18 to 26 in the Coliseum, Chicago, was the Mecca of conventions this year. Reports of parts of several accompany this article, others were held after this number was on the press and will be reported later.

The exhibit was larger than ever, spreading over all the available space in the Coliseum and annex. A late count shows about 225 exhibitors, and not all those who doubled up with others are included.

There were 12 cement companies, notable among which were the Alpha, Atlas, Chicago, German-American, Lehigh, Marquette, Sandusky, Universal and Wolverine.

All conceivable materials and machinery and tools for using cement were on exhibit, and it is impossible to name them all. A few of the more notable are all that can be crowded into this brief mention.

Among the exhibitors of concrete mixers the Ashland Steel Range and Manufacturing Co. is deserving of special notice. Waterproofings of various sorts were shown by the American Asphaltum and Rubber Co., Chicago, the Barrett Manufacturing Co., Chicago, the Girvan-Nachod Co., Philadelphia, with aquabar, Standard Asphalt and Rubber Co., Chicago.

The Fisher Hydraulic Stone and Machinery Co., Baltimore, Md., as usual, had one of the most notable exhibits of machinery for making concrete blocks. Robert W. Hunt & Co., Chicago., had a model cement testing laboratory in active opera-

tion. The Marblehead Lime Co. showed the many uses of hydrated lime. Meacham & Wright had their usual popular headquarters for receiving the many friends they have among the users of Utica natural hydraulic cement and Lehigh Portland cement. The Troy Wagon Works Co., Troy, O., showed their bottom dump boxes and wagons, a teaming gear and a reversible road-building wagon. The Universal Brick Co., Utica, Ill., made a good showing of the very excellent pressed cement brick which they manufacture. The Waterloo Cement Machinery Corporation, Waterloo, Iowa, showed the full line of "Polygon cement machinery," mixers, engines, block, brick and tile machines, etc.

The decorations remaining from the automobile show were made use of and added to largely. The prize monument at the center of the show was an attraction for all. Electricity was the motive power for most of the exhibits, some of which showed sectional working models. All these things and the conventions, perhaps, joined to make this the greatest show with the largest attendance that has yet been brought together.

National Association of Cement Users.

The sixth convention of the National Association of Cement Users was held at the Auditorium Hotel, Chicago, February 21-25.

The afternoon of the first day was devoted to the meetings of the section committees of the society and the section on Roadways, Sidewalks and Floors. The usual addresses of welcome opened the evening session. Tuesday evening's session was largely a Washington's birthday celebration, and the rest of the convention was all hard work three sessions a day, without any reference to the Cement Show.

Among the more important papers on the program were the following: "Concrete Blocks in Road Construction," by Geo. C. Wright, C. E., Rochester, N. Y.; "Concrete Road Construction," by Fred R. Charles, City Engineer, Richmond, Ind.; "Laying Concrete Under Water," by Olaf Hoff, C. E., New York; "Groined Arch in Large Reservoirs," by T. H. Wiggins, C. E., New York; "Waterproofing of Concrete," by C. M. Chapman, New York; "The Preparation of Concrete," by Harry F. Porter, C. E., Bridgeport, Conn.; papers on reinforcement of concrete compression members by R. A. Cummings, C. E., Pittsburg, Pa., L. S. Moisseiff, C. E., New York, N. Y., Prof. Peter Gillespie, Toronto, Ont., Sanford E. Thompson, C. E., Newton Highlands, Mass.; "Strength of Flat Reinforced Concrete Plates," by A. B. MacMillan, C. E., Boston, Mass.; "Long Span Light Floor Reinforced Concrete Construction," by E. G. Perrot, Arch., Philadelphia; "Concrete Drain Tile," by J. H. Libberton, Chicago, Ill.; "Hollow Concrete Block Construction," by E. B. McCready, Allentown, Pa.; "Floor Construction Cost with Separately Molded Concrete Members," by C. D. Watson, Syracuse, N. Y., and Mason D. Pratt, city engineer, Harrisburg, Pa.; concrete for houses and farm buildings, by S. Cunningham, Jr., New York, C. R. Knapp, Philadelphia, and M. D. Morrill, Arch., Washington, D. C., concrete in sea water, by C. M. Chapman, New York, C. C. Horton, San Francisco, and Ralph Barker, San Francisco.

There were also some excellent committee reports, particularly the standard specifications proposed for adoption for street pavements, curb and gutter, sidewalks, architectural concrete blocks, drain tile, and the proposed standard building regulations for reinforced concrete.

The election of officers was held too late to be reported here.

Northwestern Cement Products Association.

The Northwestern Cement Products Association held its convention in a parlor at the Great Northern Hotel, Chicago, Friday afternoon, Saturday morning and Monday, February 18, 19 and 21.

The addresses were by E. M. Hagar, president of the Cement Products Exhibition Co., O. U. Miracle, of the Miracle Pressed Stone Co., Minneapolis, Minn., on "Cement Sewer Pipe," A. W. Menk of the Consolidated Elevator Co., on "Concrete Country Grain Elevators," and J. V. Godfrey, of Moorhead, Minn., on "A Concrete Cattle Barn." The convention was not large, and with the regular president ill and secretary resigned it was somewhat at a loss. The Universal Portland Cement Co. filled in Saturday afternoon with a trip to its Chicago plant. The election of officers took place too late to be included in this report.

Standardizing Paving Specifications.

The first convention of city officials and engineers for the purpose of standardizing paving specifications is in session as this number of MUNICIPAL ENGINEERING goes to press. It was called by the Board of Local Improvements of Chicago under the temporary chairmanship of Frank T. Fowler. Two days, Monday and Tuesday, were provided for organization, and the discussion of brick, wood block and asphalt specifications were each assigned a day.

The American Society of Municipal Improvements at its last convention appointed a committee on standard specifications which is represented at the convention, the need for standards, particularly in paving matters having been felt in that organization for some time. It is hardly probable that the convention can take final action on all the specifications under consideration at this first meeting, but the discussion at a meeting called expressly for the one purpose should cause a long step in advance.

The officers of the permanent organization are Frank T. Fowler, superintendent of streets, Chicago, president; Geo. W. Tillson, chief engineer of highways, New York City, vice-president; W. J. Hardee, city engineer, New Orleans, vice-president; L. W. Rundlett, city engineer, St. Paul, Minn., vice-president; Geo. W. Craig, chief engineer, Omaha, Neb., vice-president; John B. Hittell, street engineer, Chicago, secretary and treasurer.

Cement Tile Manufacturers.

The Interstate Cement Tile Manufacturers' Association held its convention at the Lexington Hotel, Chicago, February 22 and 23. L. L. Bingham, of Estherville, Iowa, president, was responsible for the program, which included the following papers: "The Steam Curing of Cement Tile," by A. B. Elliott, Turin, Ia.; "The Cement Tile Industry, Past and Future," by C. W. Boynton, Universal Portland Cement Co., Chicago; "The Sale of Cement Tile," by E. M. Middleton, Estherville, Ia.; "The Use of Cement in Winter and Notes on Steam Curing," by George Dieckmann, chief chemist Northwestern States Portland Cement Co.; "Should Cement Tile Be Dense or Porous?" by C. F. Hunt, Lafayette, Ind.; "Data on the Rack System," by George F. Sokal, Sibley, Ia.; "Marketing Our Product," by R. L. De Nice, Sac City, Iowa.

Charles E. Sims, Worthington, Minn., is secretary of the association.

Ohio Engineering Society.

The annual meeting of the Ohio Engineering Society was held at Columbus, O., Feb. 8, 9 and 10. Among the papers submitted were the following: "Some Principles Governing the Design of Small Sewage Purification Plants," by Paul Hansen, Assoc. Mem. Am. Soc. C. E., acting chief engineer Ohio State Board of Health. George P. Shute, of Bradbury & Shute, civil and sanitary engineers, of Columbus, contributed a description of a small water works system installed under his supervision at Medina, O. Col. J. M. Harper, of the committee on highways, reported on the "Road Preservatives and Dust Suppression Materials in Hamilton County, Ohio." He said: "Tarvia has been used on 13½ miles of macadam roadway and asphalt oil as a dust eliminator on 45½ miles. The use of these materials is reported to be satisfactory. The specifications provide for the application of from 2 to 2½ gallons of tarvia per square yard, which was paid for at a uniform price of 25 cents per square yard, including application. Roads treated 18 months ago, subjected to heavy traffic, are reported to be in good condition. The application of oil cost on an average of 2.9 cents per square yard, according to Col. Harper.

Clinton Cowen, county surveyor, read a paper on road construction in Hamilton county, Ohio, and Frank R. Lander, of Cleveland, county surveyor of Cuyahoga county, described the extensive road improvements of that county. D. W. Leitz, assistant state highway commissioner, described the experimental road recently constructed by the state highway department near Columbus. A paper descriptive of a flat slab reinforced concrete construction for road crossings over small waterways was read by Frank H. Kennedy, of Washington C. H. A. M. Felgate gave a detailed description of the Rocky river bridge at Cleveland.

Officers for the ensuing year were elected as follows. E. G. Bradbury, Columbus, Ohio, president; John Laylin, Newark, Ohio, vice-president; C. J. Knisely, New Philadelphia, Ohio, secretary-treasurer; J. M. Harper, Cincinnati, Ohio, F. J. Cellarius, Dayton, Ohio, A. F. Cole, Marietta, Ohio, and B. E. Trask, Granville, Ohio, trustees.

Technical Meetings.

The annual convention of the American Water Works Association will be held at New Orleans, La., April 26, 27, 28, 29 and 30. J. M. Diven, secy., 14 George st., Charleston, S. C.

The annual meeting of the Illinois Water Supply Association will be held at Champaign, Ill., March 8 and 9. Among the papers to be presented are the following: "Experience With Deep Well Pumps," F. C. Ainsbury, Champaign, Ill.; "Relation Between Typhoid Death Rate and Water Supplies of Illinois,"; Edward Bartow, Urbana, Ill.; "Water Supplies From Lake Michigan," W. C. Bouton, M. D., Waukegan, Ill.; "The Operation of Mechanical Filters," J. H. Brewster, Indianapolis, Ind.; "The Possibility of Pollution of Shallow Wells," C. B. Burdick, Chicago, Ill.; "Quality of the Waters of the Mississippi System," R. B. Dole, Washington, D. C.; "Legislation in Relation to Stream Pollution," H. M. Ely, Danville, Ill.; "A State Bureau of Municipal Information," J. W. Garner, Urbana, Ill.; "Use of Ozone in Treatment of Western Waters," W. F. Monfort, St. Louis, Mo.; "Action of Mississippi River Water on Metals," W. F. Monfort, St. Louis, Mo.; "Filtration of Water Supplies," J. L. Pearse, Chicago, Ill.; "Water Works Franchises," M. H. Robinson, Urbana, Ill.; "A City Water Supply from Shallow Wells," O. T. Smith, Freeport, Ill.; "Rate of Flow of Water Into Wells," A. N. Talbot, Urbana, Ill.; "Comparison of Hydrated Lime with Ordinary Lime in Water Treatment," C. E. Thomas, Chicago, Ill.; "Should Water Companies Furnish Private Services Free to Patrons to and Including the Meters?" E. P. Wheeler, Lake Forest, Ill.; "Significance of the Term Alkalinity in Water Analysis and the Determination of Alkalinity by Means of Indicators," E. W. Washburn, Urbana, Ill.; "Disinfection of Water," C. E. A. Winslow, Boston, Mass.; President's Address, Dabney H. Maury, Peoria, Ill.

The twenty-sixth annual meeting of the Connecticut Society of Civil Engineers was held at New Haven, Conn., February 8 and 9. Among the lectures was one on "The Water Resources of the Navajo Reservation, Arizona," by H. E. Gregory, professor of geology, Yale University, who was commissioned by the Government to investigate the whole of this arid reservation with a view of determining the amount of the water resources and the extent to which they may be utilized for the development of the region. Frederick L. Ford, city engineer of Hartford, Conn., also gave an illustrated lecture on "Eight Weeks Civic Study Abroad." Charles E. Chandler submitted a paper on "Dams Approved by Henry F. Potter," and Benjamin L. Hinckley, engineer of tests, N. Y., N. H. & H. R. R. Co., read one on "Problems Handled by the Test Department of a Large Corporation." Officers were elected as follows: President, Shepard B. Palmer; vice-presidents, Charles A. Kerry and A. W. Sperry; secretary and treasurer, J. F. Jackson.

The Civic League of St. Louis has now a long list of civic improvements to its credit from an ordinance providing for a city forester to the appropriation of nearly $2,000,000 by the city for parks and boulevards. Its latest publications are a map showing the location of the proposed improvements in this line, an illustrated report on bill-board advertising in St. Louis, showing its monstrosities and the contrast with the form this advertising takes in large foreign cities, and a defense of the provisions for a merit system which are included in the proposed city charter revision.

The proceedings of the tenth annual meeting of the National Civic Federation have been issued. The office of the association is at 1 Madison ave., New York.

The proceedings of the Merchants' Association of New York will hereafter be published in monthly numbers.

The report of the nineteenth annual meeting of the Massachusetts State Board of Trade has been issued. One most interesting section is the address of Charles W. Eliot on "The Complete Revolution in Business."

The Michigan Engineer is the annual volume of the Michigan Engineering Society. That for 1909, issued by A. L. Holmes, secretary, Grand Rapids, is unusually well put together. Three of the papers have been published in MUNICIPAL ENGINEERING, and there are several others which are equally valuable.

The Indiana Sanitary and Water Supply Association gives its whole program of fifteen papers, president's address, reports of officers, luncheon and banquet in one day, Friday, February 25. MUNICIPAL ENGINEERING goes to press too early to be able to report the success of the venture. Certainly the list of speakers is unusual, including Edward Bartow, C. Arthur Brown and J. W. Alvord of Illinois, Geo. A. Johnson of New York and Leonard Metcalf of Boston, as well as a number of sanitary experts and practical designers and operators of water plants in the state.

The second International Road Congress will be held in Brussels, July 31 to August 7, 1910, in connection with the International Exhibition. M. Mahieu, 244 boulevard Saint Germain, Paris, France, is the general secretary. He will furnish information and accept memberships. E. L. Powers, secretary of the American Road Makers' Association, 150 Broadway, New York, is his representative in America.

At the meeting of the Municipal Engineers of the City of New York, held February 23, William H. Burr presented a paper on "The Henry Hudson Memorial Bridge."

The Societa Mostra Politecnica, Milan, Italy, has an international permanent exhibition of reviews, technical journals and publications in connection wits its permanent exhibition of machinery, building materials and technical articles.

At the February meeting of the New England Water Works Association papers were read by L. G. Powers of Washington on "Depreciation" with special reference to water works accounts, and by A. O. Doane of Boston on "The Purchase of Coal on Efficiency Basis."

The proceedings of the Cincinnati meeting of the National Municipal League have been issued in a handsome volume which can be procured for $4 from Secretary Clinton Rogers Woodruff, North American Building, Philadelphia, Pa.

The monthly report of the Merchants' Association Bureau of Inspection of San Francisco, Cal., shows much work done by the bureau since full details of the work done during the month in amount and quality are given. The number of defects discovered by the association's inspectors, which have been corrected on their complaints, is evidence of the necessity and the value of the work.

At the annual meeting of the Engineers' Society of Western Pennsylvania, officers were elected as follows: E. K. Morse, president; J. O. Handy, vice-president; A. E. Frost, treasurer; A. R. Raymer and Willis Whited, directors. The annual banquet was held January 29.

At the meeting of the Brooklyn Engineers' Club, February 10, Percy C. Barney presented a paper on "The Catskill Water System of the City of New York." At the informal Thursday night talk of March 3 Thomas B. Hamilton will give an illustrated paper on "The Making of a Marble Quarry."

The American Society of Engineering Contractors is holding its special Chicago convention as this number of MUNICIPAL ENGINEERING is on the press. It gives every indication of being a live organization which will fill a place heretofore va-

cant. Report of the convention will be given next month.

The Iowa Association of Cement Users holds its convention at Cedar Rapids, March 9, 10 and 11. Ira A. Williams, secretary, Ames, Iowa.

The Iowa Engineering Society held a convention at Cedar Rapids, Iowa, February 16 and 17. About 30 members were in attendance. The program, which brought about much antimated discussion, included the following papers: "Concrete Construction in Cold Weather," J. H. Chubb; "Rates for Electric Service," A. H. Ford; "The Direct Method of Illuminating Engineering," L. B. Spinney. Reports of committees were submitted as follows: Surveying and drainage, Seth Dean; sanitary engineering, A. Marston; roads and pavements, T. H. McDonald; railroad engineering, W. G. Raymond.

The Technical Schools.

The January bulletin of Purdue University contains the annual reports of the president and other officers.

The students of the Armour Institute of Technology, Chicago, issue *The Armour Engineer,* semi-annually. The first number of the second year contains a dozen excellent practical articles, from alumni and faculty of the institution and others.

Bulletin No. 34 of the University of Illinois, Urbana, Ill., contains a report of tests of two types of tile-roof furnaces under a water-tube boiler by J. M. Snodgrass.

Bulletin No. 33 of the University of Illinois contains a report of tests of tungsten lamps by T. H. Amrine and A. Guell, which is of great interest, as it adds much to the available information on the new electric light.

Collier's Weekly has made the amende honorable for a reflection cast on the integrity of the International Correspondence Schools of Scranton, Pa., by making a thorough investigation of the methods and results of the instruction given and publishing a report which is an excellent endorsement of the institution.

Bulletin No. 337 of the University of Wisconsin contains Daniel W. Mead's paper on "The Relations of Experimental Results to the Theory of the Tangential Water Wheel," based on tests made in the hydraulic laboratory of the University of Wisconsin, which is in charge of Professor Mead.

The new engineering buildings of the University of Kansas were dedicated February 25 with addresses by Dean Frank O. Marvin, President Richard C, Maclaurin, of the Massachusetts Institute of Technology, and President Ernest R. Buckley, of the American Mining Congress.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations as follows:

March 29, 30, 31: For senior mechanical and optical draftsman at the Frankford Arsenal, Philadelphia, Pa., at $1,600 a year.

Personal Notes.

George T. Bolton has been appointed city engineer at Cohoes, N. Y.

R. L. Gardner has been reappointed city engineer at North Adams, Mass.

Bion Arnold has been appointed subway engineer for the city of Chicago.

W. F. Gollaher has been appointed superintendent of water works at Mesa, Ariz.

Frank Weaver has been appointed city engineer to succeed L. A. Dillon at Hamilton O.

H. M. Talbott has been appointed city engineer to succeed E. B. Shipley at Owensboro, Ky.

W. E. Roche has been appointed assistant engineer in the city engineer's office at Ogden, Utah.

J. E. Thompson has been elected city engineer, succeeding S. D. Newton, at Knoxville, Tenn.

A. F. Harley has established an office for practice as a consulting engineer at Jacksonville, Fla.

Christopher Harrison has been appointed city engineer, his twelfth consecutive term, at Everett, Mass.

F. B. Mayer has been elected mayor and A. F. Helingren and G. R. Adams city commissioners at Alice, Texas.

Fayette Brown, president of the Brown Hoisting Machinery Co., Cleveland, O., died January 20, in his 87th year.

C. R. Eager, president of the California Construction Co., of San Francisco, Cal., died in that city recently, aged 63 years.

Mr. Alexander Potter has been elected an honorary member of the Association of Managers of Sewage Disposal Works of Great Britain.

W. J. Frederick has been elected mayor, and W. T. Keer, F. W. Baebel, J. W. Hill, B. F. Davis and W. B. Johnson, aldermen, at San Felix, Tex.

Cuno H. Rudolph, Gen. John A. Johnston and Major W. V. Judson compose the reorganized board of district commissioners of the District of Columbia.

Hon. John F. Fitzgerald, first mayor of Boston under the new city charter, which provides for a term of four years, was inducted into office February 7.

J. Q. Worley, of Kansas City, has been retained by the city of Wichita, Kan., to advise as to the value of the water plant which the city contemplates purchasing.

P. H. Norcross, Assoc. M. Am. Soc. C. E., of the Solomon-Norcross Co., Atlanta, Ga., has been appointed consulting engineer for the Georgia State Board of Health.

Nicholas S. Hill, Jr., consulting engineer, New York city, has established a laboratory for making tests and investigations in connection with water works and sewerage problems.

Henry B. F. Macfarland, for some years commissioner of the District of Columbia, is a member of the new law firm of Tucker, Kenyon & Macfarland, with offices at 1420 New York ave., Washington, D. C.

P. B. Beery, for fourteen years assistant manager of the Sandusky Portland Cement Co., Sandusky, O., has resigned to accept the position of secretary and treasurer of the Allentown Portland Cement Co., which will begin cement shipments in April with a daily output of 3,000 barrels. He will be in charge of the sales department. Charles A. Matcham, formerly general manager of the Lehigh Portland Cement Co., is president and general manager of the new plant, which

is a modern model designed so as to be readily doubled in capacity.

Charles A. Brown, who has been connected with the city engineer's office at Indianapolis, Ind., for fifteen years, has resigned and will engage in consulting practice ,with offices in the Indiana Trust Building.

Sam R. Murray, superintendent of the municipal asphalt repair plant at Indianapolis, Ind., from June, 1908, to January 1, 1910, has taken charge of the asphalt department of the bureau of highways at Denver, Colo.

Lewis C. Ashbaugh, M. Am. Soc. C. E., has been appointed assistant chief engineer of the county highway project at Los Angeles, Cal. Mr. Ashbaugh was formerly office engineer of the Central Colorado Power Co., at Denver.

Leonard C. Smith, who has been chief engineer of the department of water supply, gas and electricity, borough of Queens, New York, has been appointed engineer in charge, under the reorganization plan, reporting to the chief engineer, I. M. deVarona.

F. A. Hall, long with the Yale & Towne Mfg. Co., Stamford, Conn., as manager of the chain block and hoist department, has resigned to become vice-president and treasurer of the Cameron Engineering Co., Brooklyn, N. Y. R. T. Hodgkins, long his chief assistant, has been promoted to fill the vacancy.

MACHINERY AND TRADE

The Cummer Portable Asphalt Paving Plant.

Nine of the Cummer one-car portable paving plants for building sheet asphalt, tar and asphalt macadam pavements were built in 1909. The plant consists of a sand drum with a capacity of 20 tons an hour; a steam-jacketed Iroquois mixer of 9 cubic feet capacity with steam cylinder for opening gate; a 5-ton capacity steel sand bin with rotary screen; 3 open kettles, with hinged covers, each 280 cubic feet capacity with a small steam-jacketed pressure tank to discharge melted asphalt to mixer platform; an oil pump and measuring tank; two dryer elevators for sand or rock, and one steel-encased hot-sand elevator, a sand box on scales with two beams and tare beam; an asphalt crane with hoisting engine and drum; 4-inch asphalt piping with 5-inch steam jacket; 80-h. p. engine; 9½-inch air pump, 60-h. p. vertical boiler, etc. A mechanically agitated closed kettle can be substituted for one of the open kettles. The large capacity of the plant is attributed to the large capacity of the sand dryer, which supplies all the sand the plant can possibly use.

Full information about the plant will be given by F. D. Cummer & Son Co., Cleveland, O.

Cement Brick.

The Universal Brick Co., Utica, Ill., have issued a comprehensive booklet describing in full and illustrating the process of manufacture, the buildings and machinery and the quality of the cement brick made by them. The booklet was prepared by W. P. Cosgrove, Indianapolis, and shows care and experience in preparing such literature.

The company uses the famous Utica or Ottawa silica fire sand and Utica cement, which are mixed and ground in one operation, then pugged, receiving the required moisture, then pressed and subjected to a special cement curing treatment, after which the bricks are ready for the wall.

Crushing tests by various engineering laboratories show ultimate strength of 5,692 to 7,668 pounds per square inch, most of the results lying between 6,250 and 6,625 pounds. Absorption is between 7 and 8 per cent. after 48 hours' soaking. Freezing tests, 20 freezings varying in length from 7 to 39 hours, showed almost infinitesimal losses in weight, the greatest loss in any one brick being less than one-third of 1 per cent., and some showing as low as one-twentieth of 1 per cent. The company will send copies of the booklet on request.

Waterproofing a Reservoir.

The Bedford reservoir at Pittsburg has an area of surface to be waterproofed amounting to 5,615 square yards. After the first layer of concrete, 4 inches thick, was laid and had become perfectly dry all dust was carefully brushed off and a heavy coat of Pioneer primer paint, made by the American Asphaltum and Rubber Co., of Chicago, was applied with ordinary paint brushes. On this primed surface was mopped a heavy coating of Pioneer reservoir waterproofing asphalt, applied at a temperature not less than 450 degrees F., to a thickness not less than one-eighth inch. Over each joint in the concrete was laid a single layer of asphalt saturated wool felt, 8 inches or more in width, which was laid in hot asphalt and then mopped carefully and heavily with the waterproofing asphalt.

After the waterproofing asphalt cooled

the next layer of 4 inches of concrete was laid, and this layer was waterproofed. Then a granolithic finish was laid on the exposed or finished surface by the alternate block method.

The accompanying photograph shows the first set of blocks laid and the workmen beginning the laying of the alternate blocks. Other workmen are applying asphalt on the side slopes of the reservoir.

Trade Publications.

The latest issue of *The Edison Aggregate* gives a number of photographs of beautiful concrete homes in cement stucco, poured concrete, concrete and stucco, and reinforced concrete.

Publication 387 of the National Brake and Electric Co. is devoted to motor-driven air compressors, type 3Vs.

Vulcanite Pamphlet No. 9 contains the article on "Uses of Mineral Oil Mixed Concrete," by Albert Moyer, which appeared in the February number of MUNICIPAL ENGINEERING.

The latest publication of the Association of American Portland Cement Manufacturers contains the progress reports of its committee on technical research on the action of oil on concrete and the effect of temperature on the hardening of concrete.

Bulletin No. 7 of the Adjustable Steel Centering Co. on methods of constructing monolithic concrete sewers, culverts and conduits is received.

Circular No. 17 of the International Exhibition of Railways and Land Transport, to be held in Buenos Aires, Argentine Republic, May to December, 1910, gives the program of the exhibition, fees and charges and much other information about the exhibition and the city.

Sewers, tanks and walls and their reinforcement when built of concrete are the subject of a booklet of the Northwestern Expanded Metal Co.

Specifications for Portland cement are issued by the American Bureau of Inspection and Tests.

The Lock Joint Pipe Co., 165 Broadway, New York, shows in a well-constructed booklet the Meriwether system of continuous reinforced concrete pipe. Howard Egleston, Chattanooga, Tenn., is sales manager for the Southern States.

The Cement Tile Machinery Co., of Waterloo, Iowa, sends an interest-compelling reminder of its factory, the machine it makes, and the tiles made by the machine.

The trade publication of the Crane Co., Chicago, is known as *The Valve World.*

Bulletin 69 of the Universal Portland Cement Co., shows many large buildings, chimneys, railroad structures and a dam in which Universal cement has been used.

The Economy Drawing Table Co., Toledo, O., sends a new catalog of the drawing tables, sectional filing cases and specialties in the same lines which they manufacture and which are so satisfactory to those who have purchased them.

Spiral riveted pipe and flanges for the same, hydraulic and exhaust steam supplies are described in pamphlet No. 30 of the American Spiral Pipe Works.

The Goheen Mfg. Co. issues an occasional new illustrated pamphlet on carbonizing coating.

Industrial Engineering and the Engineering Digest will be the name of the combination of the two papers included in the title, and the office will be at 220 Broadway, New York.

The monthly *Pipe Parley* of the McWane Pipe Works, Lynchburg, Va., announced the destruction of office and warehouse by fire on January 1, but as the works were not damaged the manufacture of pipe was not interrupted. Pipe prices are quoted at $26 a ton for 6-inch in New York and Birmingham.

The Bush type of train shed is fully described in a reprint from *Architecture,* entitled "A New Type of Train Shed."

The Scioto Fire Brick Co. issues an illustrated catalog of the many shapes and purposes of their fire brick.

The Barrett Mfg. Co. sends a handsome photograph of the new Pennsylvania railroad station, in which its specification pitch and felt have been used exclusively. Coal tar pitch and felt waterproofing which had been in the ground for thirty years were found in the buildings torn down for the station, and showed no change in chemical or waterproofing qualities.

Three valuable volumes on sewage collection and disposal are fully advertised in an illustrated circular of the Standard Sanitary Mfg. Co., Pittsburg.

The Mills memorial water works system of Thorntown, Ind., is described by Chas. Brossmann in a late booklet of the Lehigh Portland Cement Co.

The latest addition to German industrial literature is the monthly *Der Industriebau,* published by Carl Scholtze, Leipzig, which is devoted to the design and construction of factories, including all engineering structures and the technical matters connected therewith.

The last number of *Farm Cement News* issued by the Universal Portland Cement Co. devotes considerable space to cement exhibits at state fairs. Each fair should have a cement industries building in which the farmers can be instructed in the many uses of cement on the farm and the road. The movement for such buildings meets the approval of many who are interested in the advancement of agriculture.

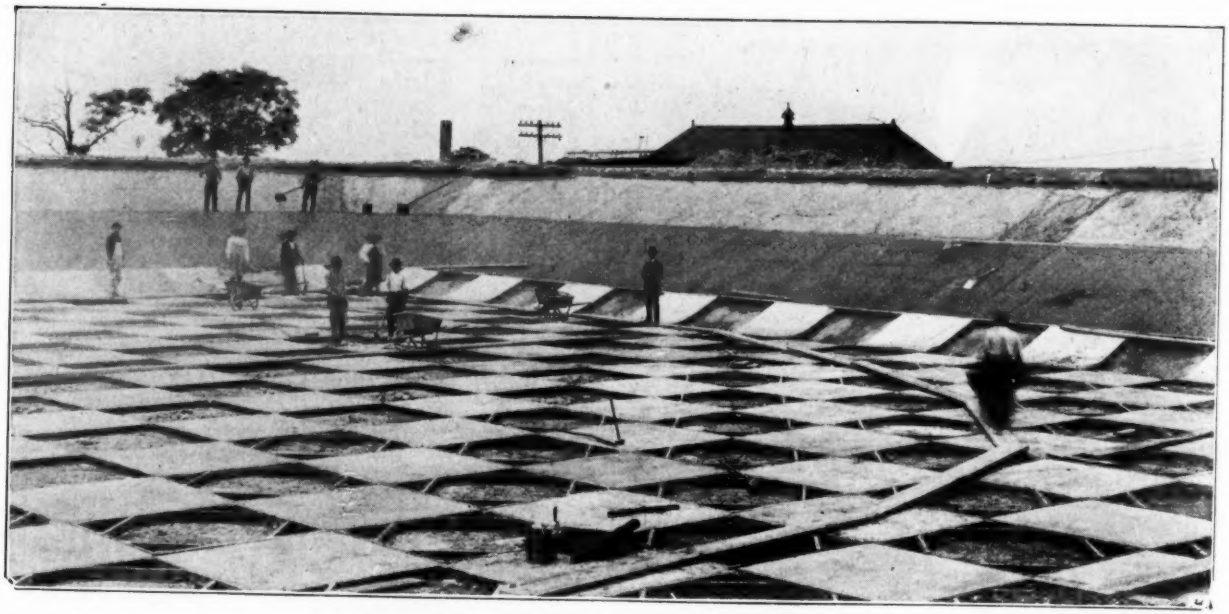
Trade Notes.

ASPHALT.

Chehalis, Wash.—Special.—E. J. Hermans, cy. engr., advises us that he desires to purchase a municipal asphalt plant for a city of 8000.

Wichita, Kan.—Many of the citizens of this city advocate the purchase of a municipal asphalt plant.

Denver, Colo.—A contract for building a municipal asphalt plant has been awarded



WATERPROOFING BEDFORD RESERVOIR. PITTSBURG, PA.

to Hetherington & Berner, of Indianapolis, Ind., for $17,150.

BRICK.

Mt. Carmel, Ill.—The Mt. Carmel Vitrified Brick & Sewer Pipe Co. has been incorporated to manufacture paving brick and sewer pipe, by W. A. Stansfield, John E. Willis and J. S. Stansfield.

Ft. Wayne, Ind.—The Sprang Clay Products Co. has been incorporated to manufacture, buy and sell clay products, by Milo J. Sprang, Milo J. Gorrell, Jr., and A. J. Neireiter.

The Moores Coney Co., of Cincinnati, wholesale dealers in lime, cement and brick and builders' supplies, have purchased the controlling interest in the Harris Brick Co., at Zanesville, O., and an entire new line of brick machinery is being installed to manufacture the Harris Pavers. The plant should be in operation about April 1. Mr. Ellsworth Ogden, of Columbus, who has had a wide experience in the brick business, is in charge of the reconstruction, and will remain in charge of the plant. Mr. Peter Gorter will have charge of the sales department. The plant is located on the Belt Line with direct connection with the B. & O., Hocking Valley, Pennsylvania and the Wabash systems, thus conferring the best shipping facilities.

CEMENT.

Chamberlain, S. D.—The Dakota Portland Cement Co. will begin the erection of a plant for the manufacture of cement on March 15.

Keokuk, Iowa.—The Keokuk & Hamilton Water Power Co. has begun the erection of a cement plant at Hamilton, Ill.

CONCRETE BLOCKS.

Louverne, Minn.—The Louverne Concrete Co. has been incorporated by L. E. Coss, Dr. C. L. Sherman, C. J. Martin, H. E. Cornish, H. E. Peterson and E. R. Coss. H. E. Cornish is manager.

Humboldt, Ia.—The Humboldt Cement Products Mfg. Co. is erecting a cement block plant.

PURCHASE OF MACHINERY.

Perkasia, Pa.—Special.—A. M. Bean, mayor, says the borough council has passed a resolution to purchase a power road roller.

Trenton, N. J.—Special.—T. J. McGovern, general contractor, Fischer Bldg., desires prices and information regarding street cleaning machinery and up-to-date sweepers.

Tama, Ia.—Special.—D. F. Coe is in the market for a second-hand steam engine, 4 or 6 h. p.

Houston, Tex.—Special.—C. S. Woods, prest. Western Land Corporation, desires to purchase a rock crusher of 50 yds. daily capacity.

Montreal, Can.—Special.—Hilder Daw, C. E., 790 City Hall ave., is in the market for machinery and tools for constructing, and materials for building.

Normal, Ill.—This city has purchased four fine machines for the street department from the Studebaker Mfg. Co., of South Bend, Ind., including a large dump wagon, a street sweeper, a street sprinkler, and a machine for refilling the sweeper broom.

Landor, Wyo.—Special.—J. C. Edsall is in the market for dump wagons to use with traction engines.

Edmonton, Can.—Special.—B. F. Mitchell, secy. Edmonton Engineering Society, Archibald Block, advises us that the Edmonton Engineering Society is open to receive catalogues, etc., from manufacturers.

Creston, Ia.—Special.—Thos. S. DeLay, cy. engr., says this town will shortly be in the market for an elevating grader suitable for street grading where it is necessary to load the dirt in wagons. He desires to communicate with the producers of such machines and with any parties who have a second-hand machine for sale. He also desires information regarding a combination traction engine and road roller with gas power.

Los Angeles, Cal.—Bids will be asked soon, by the board of supervisors, for furnishing 4 steam road rollers of 13½ tons each.

PURCHASE OF MATERIALS.

Lander, Wyo.—Special.—J. C. Edsall advises us that he is in the market for Portland cement.

Creston, Ia.—(Special)—Thos. L. De Lay, cy. engr., desires up-to-date information on the cost of quarrying and crushing rock for concrete and road building.

LIGHT, HEAT AND POWER.

Portland, Me.—The Hydro Power Co. has been incorporated to deal in engines, pumps, etc., by F. W. Hayden, of Randolph, Mass., and C. H. Tolman, of Portland.

SEWER PIPE.

Spokane, Wash.—Work on the big sewer plant to be erected by the Washington Brick, Lime & Sewer Pipe Co. will begin as soon as the weather is favorable. The company was recently organized with J. H. Spear as president and general manager; William M. Colby, vice-president; S. J. Coal, secretary; T. E. Redmond, treasurer; L. A. Spear, assistant manager.

MISCELLANEOUS.

Newton, O.—Special.—The sales department of the G. W. Parsons Co. will be consolidated with the home office in this city. Geo. F. Lambert and Geo. M. King, who represent the sales department, will maintain their residences in Des Moines and both parties can be seen at their homes or be called there by long distance phone after office hours.

Gerald Priestman has been employed by Merritt & Co., of Camden, N. J., as manager of sales for their department of hydraulic specialties. Mr. Priestman was formerly with Pugh & Hubbard, consulting engineers, of Philadelphia, and later sales manager for a well-known New York company.

Patents Concerning Cement Blocks, Bricks and Artificial Stone.

856,176. Composite Building Block. Jas. Muir, Springfield, Mass.

856,213. Mold for Making Concrete Blocks and Artificial Stone. Wm. A. Benton, Ft. Worth, Tex.

863,711. Device for Molding Vesse's, such as Flower Pots and the Like. Conrardus Geraedto, Adrianus Blocks, Jr., and Wilhelmus Byvoet Az, Roermond, Netherlands.

866,175. Cement Brick Pressing Machine. Philip K. Young, Omaha, Neb.

867,427. Cement Gate Mold. Ira Shively and Jay Huber, Dexter, N. M.

870,370. Process for Making Artificial Stone and Concrete. Frank S. Lamson, Washington, D. C.

876,280. Concrete Block Machine. Frank Morcher, Tiffin, O.

877,870. Apparatus for Molding Artificial Stone Blocks (curb). Jas. W. Shone and John N. Rauber, Rochester, N. Y.

877,874. Mold for Cement Blocks. Stoyan Tsanoff, New York, N. Y.

877,996. 877,997. Concrete Building Block Wall. Frank M. Henry, Minneapolis, Minn.

878,417. Artificial Stone Machine. Thos. A. McMurtrie, Los Angeles, Cal.

878,542. Cement Block and Brick Machine. Solomon M. Kimble, Jackson, Mich.

878,945. Cement Block Machine. Ross Endsley, Marion, Ind.

879,066. Core for Building Blocks. Edward Rhodes, Dresden, O.

880,066. Concrete Sidewalk Block. Chas. Deez, Madison, Wis.

880,201. Apparatus for Molding Concrete and the Like. Chas. Dietrichs, Little Ferry, N. J.

880,495. Concrete Block Machine. Albert F. Barnes, Neola, Iowa.

880,782. Face Plate for Cement Block Molds. Geo. W. Dunlap, Vancouver, B. C.

880,886. Machine for Making Cement Brick and the Like. Fred C. Hohn, Greencastle, Ind.

881,164. Press for Manufacturing Briquets, Blocks, Artificial Stone, and the Like. Wilhelm Surmann, Cologne, Germany.

881,224. Corner Lock for Cement Molds. Hugh A. Carmichael, West Lorne, Ont., Can.

881,513. Cement Block Machine. John Wengs, Monroe, Mich.

881,815. Cement Brick Machine. Daniel H. Merritt, Lincoln, Neb.

882249. Cement or Concrete Block Mold. Arthur M. Haight, Jackson, Mich.

882,414. Hollow Concrete Block. Herbert N. Pettigrew, New Orleans, La.

882,633. Building Block and Manner of Assembling. Robert A. Harris, Tucson, Ariz.

882,975. Process for Manufacturing Artificial Stone. Jacob Standt, Bonn, Germany.

883,294. Transporting and Drying Car for Cement or Concrete Blocks. Sherwood M. Chase, Columbus, O.

884,101. Cement Block Machine. John W. Miller, Jackson, Mich.

884,166. Mold Plate for Concrete Construction. Ernest G. Kemper, Dallas, Tex.

884.498. Concrete Block. Jas R. King, Petersburg, Ind.

884,713. Machine for Molding Cement Blocks. Frank Cherny, Cleveland, O.

884,931. Mold for Making Cementitious Articles. Daniel A. Keogan, White Haven, Pa.

884,965. Mold. Elias M. Walker, Wichita, Kan.

885,065. Refractory Block for Building Purposes. Frederick B. Marion, Paterson, N. J.

886,124. Manufacture of Artificial Stone. John C. Henderson, Oakland, Cal.

886,252. Process for Hardening Artificial Stone. Erich Schwanenberg and Albert Rinne, Hanover, Germany.

886,404. Machine for Forming Building Blocks. Wm. Raab, Waterloo, Iowa.

886,877. Cement Chair Mold. Mathias Serrier, Edwardsville, Ill.

887,211. Cement Block. John S. Minton, Kearney, Neb.

887,398. Brick and Block Mold. Chas. W. Jones, Charlotte, N. C.

887,432. Mold for Building Blocks. Frank M. Sawyer, Charlotte, N. C.

887,565. Apparatus for Molding Articles from Cementitious Material. Alex. Zuberbuhler, Toronto, Ont.

887,814. Mold for Hollow Concrete Blocks. Levi S. Johnson, Sioux City, Iowa.

877,933. Concrete Block Mold. Bernard A. Tuller and Miles Bateman, Centerville, Iowa.

889,569. Concrete Composition for Building Material. Herman S. Albrecht, St. Louis, Mo.

889,633. Apparatus for Forming Artificial Blocks. Albert A. Pauly, Youngstown, O.

889,943. Apparatus for Laying Walls of Building Blocks. Clawson M. Maddox, Muncie, Ind.

890,039. Machine for Molding Concrete or Cement Brick. John S. Fish, South Bend, Ind.

890,187. Artificial Stone Machine. John A. Smalley, Des Moines, Iowa.

891,312, 891,313. Concrete Chimney Block and Concrete Block. John W. White, Spokane, Wash.

891,423. Machine for Forming Concrete Blocks. Jas. Ingells, Muskegon, Mich.

892,138. Cement Block Mold. Wm. A. Crew, Salisbury, Md.

892,583. Cement Block Machine. Wm. S. Colvin, Hamilton, Kan.

894,089. Concrete Block Press Machine. Fred E. Wilkinson, Fairbury, Neb.

894,390. Down-Face Cement Block Machine. Geo. F. Newton, Kansas City, Kan.

894,744. Machine for Molding Concrete Blocks. Wm. H. Phillips, Columbus, O.

895,195. Press for Pressing Concrete Into Blocks. Enos S. Redmond, Kansas City, Mo.

895,243. Interlocking Concrete Curb Block. Sydney L. Davis, Pensacola, Fla.

895,414. Block Molding Machine. Russell B. and Wm. W. Bennett, Westerville, Ohio.

895,614. Block Molding Machine. Ole Benson, South Omaha, Neb.

896,259. Cement Block Machine. Cyrus S. Wert, Kendallville, Ind.

896,330. Mold for Concrete Building Blocks. Christian J. Scheelky, Newport News, Va.

897,552. Cementitious Building Block. Edward H. McClintock, West Somerville, Mass.

898,656. Building Block. Roy E. Keagle, Lodi, Cal.

898,703. Manufacture of Stone or Marble Artificially. Thomas M. Thorn, Woodlands, Chestnut, England.

898,911. Concrete Molding Device. Wm. C. Neeley, Pueblo, Col.

899,168. Machine for Molding Blocks. Julius Jaeger, Rutherford, N. J.

899,517. Block Molding Machine. Elmore N. Edwards, Alva, Okla.

899,799. Apparatus for Forming Building Blocks and Artificial Stone From Plastic Material. A. A. Pauly, Youngstown, Ohio.

900,272. Machine for Constructing Hollow Concrete Building Blocks. John Fish, South Bend, Ind.

900,414. Centrifugal Block Machine. Menzo Nashold, Davis Junction, Ill.

900,753. Building Block. Adam G. Mahler, Medford, N. Y.

900,910. Cement Block Machine. Geo. W. Buck, Omaha, Neb.

901,296. Machine for Making Blocks, Plates, Etc., From Plastic Materials. Chas. M. C. Hughes and Thos. H. Quinlan and Robert Middleton, London, Eng.

901,536. Artificial Stone Sewer Cap. Edward F. Kennelly, Boston, Mass.

901,740. Cement Block Machine. Geo. L. Reed, Springfield, O.

901,798. Concrete Construction (Block). Miner E. Fenner, Durand, Ill.

901,825. Concrete Block Machine. Arthur Pierce, Seville, O.

902,922. Portable Concrete Mold. David W. Smith, Ft. Worth, Tex.

903,477. Roofing Tile (Cement). Samuel A. Jones, Deshler, O.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Knoxville, Tenn.—The construction of a sample of pike road on Rutlidge pike is contemplated during this year.

Tacoma, Wash.—This city expended $670,594 during 1909 for the construction of 13.61 mis. of paved street, of which 10.04 mis. were asphalt; 1.05 mi. brick; about 2 mis. sandstone.

CONTEMPLATED WORK.

Spokane, Wash.—Plans have been completed for grading.

Eldora, Ia.—About 1 mi. of concrete paving is contemplated.

Paragould, Ark.—Paving is contemplated for the business streets.

Ft. Worth, Tex.—The city comrs. will pave 24 streets this year.

Olympia, Wash.—Brick paving is contemplated for Main st. this spring.

Toppenish, Wash.—About 10 blocks of paving is contemplated this spring.

Pontiac, Ill.—Brick paving is contemplated for Prairie st. and an alley.

Pasadena, Cal.—The construction of cement sidewalks in Pearl st. is contemplated.

DePere, Wis.—Council is considering a resolution to pave George st. with concrete.

Salt Lake City, Utah.—Council has passed ordinances for paving Fourth West st.

Sweetwater, Tex.—Vitrified brick paving is contemplated for 6 blocks of streets.

Vancouver, B. C.—Bids will be asked for constructing 10 mis. of cement work.

Des Moines, Ia.—Ordinances have been passed for paving 31st, Chester and 16th sts.

Carmi, Ill.—Concrete walks are contemplated. R. Vieler, chm. bd. local impvts.

St. Charles, Mich.—Will vote April 10 on the issue of bonds for road improvements.

Mt. Pleasant, Ia.—Paving is contemplated for about 3 mis. of paving this year.

Omaha, Neb.—The estimated cost of paving S. 13th st. with brick block is $59,529.

Sparta, Wis.—Council will take action Mar. 1 on repaving Water st. with vitrified brick.

Benton, Tex.—Macadam paving is contemplated for E. Hickory st. Z. Wiggs, cy. engr.

Canton, Ill.—Plans are being prepared for paving S. 1st ave. with brick. Jos. Waugh, cy. clk.

Marion, Ia.—Estimates are being prepared for brick paving. T. J. Cleveland, cy. clk.

Ida Grove, Ia.—About 1 mi. of asphalt paving is contemplated. Geo. C. Hubbard, cy. clk.

Osceola, Ia.—About 1,000 yards of vitrified brick paving is contemplated. W. Temple, cy. clk.

Hastings, Neb.—Will vote Mar. 8 on issue of $50,000 bonds for paving the street intersections.

Key West, Fla.—Will vote April 12 on the issue of $192,000 bonds for municipal improvements.

Eagle Grove, Ia.—Bids will probably be received in March for paving with brick. S. Middleton, cy. clk.

Waco, Tex.—Brick paving is contemplated for S. 4th, 5th, Washington and Franklin sts. Address mayor.

Ottawa, Ill.—Estimates have been prepared for paving in South Ottawa, West Ottawa, and Center Ottawa.

Beeville, Tex.—This city council is preparing to complete 15 mis. of street construction this year.

Manitowoc, Wis.—Bids will be asked soon for paving Washington, Main, Jay, Quay, Commercial and 9th sts.

Mankato, Minn.—Bids will be asked during March for paving 2nd st. with brick. John Wilson, cy. engr.

Seattle, Wash.—Plans are being prepared for regrading the district between 5th ave., Denny Way and Westlake ave.

Michigan City, Ind.—Plans have been completed for brick paving in Hermitage ave. H. M. Miles, cy. engr.

Ocean Park, Cal.—Asphalt resurfacing is contemplated for the Speedway, and concrete sidewalks for Florence ave.

Evansville, Ind.—Bids will be asked for paving Powell ave. and Tennessee st. with brick. Emil Pfafflin, cy. engr.

Clarinda, Ia.—Final action will be taken Mar. 5 on curbing and paving Chestnut and other streets with concrete.

Oneonta, N. Y.—The city engineer has been directed to prepare plans for paving upper Main and Chestnut sts.

Hartford, Conn.—The bd. of st. comrs. voted to construct ½ mi. of asphalt macadam road in Farmington ave.

South Bend, Ind.—A petition is being circulated asking that E. 4th, 3rd, Spring and E. Joseph sts. be paved.

Washington, Ia.—A petition has been submitted to council asking that Washington st. be paved to the city limits.

Muncie, Ind.—Plans and specifications will be prepared for paving Kilgore ave. and York Twp. pike with brick.

Oil City, Pa.—Plans have been prepared for about 60,000 sq yds. of paving with curbing. G. F. Roess, cy. engr.

Kearney, Neb.—Petitions are being circulated for paving 50 blocks of streets with brick block. Mayor Patterson.

Wausau, Wis.—Plans are being prepared for 9,300 sq. yds. creosoted wood block paving in 3rd st. B. C. Cowen, cy. engr.

Huntington, Tenn.—Voted to issue $10,000 bonds for street improvements, electric lights and water mains in the East End.

Benicia, Cal.—Final specifications have been adopted for paving Main and other streets; and a bond election will be called.

Sheridan, Wyo.—A committee has been appointed by city council to investigate the question o fpaving the principal streets.

Salt Lake City, Utah.—The city council has decided to construct 3 mis. of side-

walks in the northwestern section of the city.

Fairfield, Ill.—Plans have been prepared for paving Center st. John Moreland, engr.; H. W. Pitner, men. bd. local impvts.

Wenatchee, Wash.—The city council has taken steps toward forming an improvement district for grading, macadamizing, curbing, etc.

Beloit, Wis.—A contract will be let within 60 days for paving Prairie and Euclid aves. and 8th and Cross sts. B. E. Wood, cy. clk.

Bloomington, Ill.—City engineer Folsom has been directed to prepare plans and estimates for paving W. Washington st. with brick.

Toronto, Ont.—C. H. Rust, cy. engr., has recommended the construction of asphalt block paving in College st. as a cost of $52,619.

Elgin, Ill.—Spring st. will probably be paved with brick during 1910 at a cost of $61,000; Walnut ave., $45,000; S. State st., $22,000.

Benicia, Cal.—Final specifications have been adopted and the city trustees will pass resolutions calling for a bond election to vote on the issue of $100,000 bonds for paving Main and other streets.

Jamestown, N. Y.—A resolution has been adopted for paving Taylor st.

El Campo, Tex.—E. H. Koch has been elected president and W. A. Hiddleston secretary of an association formed to secure good roads and drainage.

Lowville, N. Y.—A resolution has been adopted approving plans and specifications for the county highway to be constructed from Harrisburg here.

Oakwood, O.—Macadam paving is contemplated for the pike leading into this village, by the county commissioners. Kenneth Allen, cy. engr., is interested.

Los Angeles, Cal.—Homer Hamilton, cy. engr., has been directed to prepare ordinances for improving a number of miles of streets with asphalt and macadam.

Hamtramck, Mich.—Plans have been completed for 14,000 sq. yds. of brick paving, and bids will be asked about Mar. 1. Harry M. Jacobs, vil. clk., Detroit.

Mt. Vernon, Wash.—J. E. Schauber, chm. Commercial Club com. on paving, is collecting information regarding paving, preparatory to paving the entire business section of this city.

Binghamton, N. Y.—The city engineer has been directed to prepare plans and specifications for brick paving in Alice st.; brick and wood block paving in Main st.; brick and asphalt paving in Front st.

Everett, Mass.—Mayor Bruce has recommended more granite block paving on concrete base, more brick paving, and an investigation of the merits of dust-laying application. Chris. Harrison, cy. engr.

Fremont, Neb.—The construction of good roads is urged by the Commercial Club. R. B. Schneider, M. G. Perkins, D. V. Stephens, and B. W. Reynolds have been appointed to co-operate with the Commercial Club.

Quincy, Ill.—A petition has been submitted to city council asking that the streets between Vermont and Jersey and 3rd and 8th be resurfaced with such material as may meet with the approval of the bd. of local impvts.

Glasgow, Ky.—(Special). J. U. Rogers advises us that the prospect of expending $3,000 to $5,000 annually in constructing streets, beginning in the early spring and summer and continuing until all streets, about 12 mis., are paved, is bright.

Houston, Tex.—A new paving plan has been adopted by the citizens on Travis st., who have asked that the street be paved for a distance of three blocks with shell, and agreeing to pay their pro rata for the paving as soon as the work is completed.

Chicago, Ill.—Albert F. Keeney, president; Chas. A. V. Standish, secretary, and Felix A. Norden of the bd. of local impvts., visited New York City and Washington recently to inquire into the success of creosoted wood blocks as a paving material.

Washington, D. C.—Plans have been perfected by the Washington-Alexandria Greater Highway Association to finance the proposed Washington-Alexandria highway. A macadam roadbed, 11 in. thick with a tar or asphalt binder, is proposed, at a cost of about $10,000.

Trenton, N. J.—(Special). T. G. McGovern, general contractor, advises us that this city is about to advertise for bids to clean and reface all paved streets by contract by the sq. yd. He desires information regarding the same and is ready to receive prices on machinery and up-to-date sweepers.

Eveleth, Minn.—The city engineer has estimated the cost of paving Grand ave. as follows: Tar macadam with cement base, $21,530; Telford macadam, $26,040; creosoted block with concrete base, $36,738 and tar macadam with crushed rock base, $20,777. He will prepare an estimate of the cost of cement paving.

Stockton, Cal.—The highway com'n has ordered plans and specifications prepared for road improvements, as follows: Cherokee Lane to Eight-Mile House, a distance of 8 miles; Waterloo Road, a distance of 7 miles; Linden Road, a distance of 12 miles; French Camp Road, 10 miles; Mariposa Road, 12 miles, and West Side Road, a distance of 23 miles; approximate cost, $700,000.

CONTRACTS TO BE LET.

Cincinnati, O.—Bids are asked until Mar. 4 for improving the Nelson road. Bd. co. com'rs.

Montgomery, Ala.—Bids are asked until Mar. 7 for paving Monroe st., Jeff Davis ave. and other streets, and constructing sidewalks in Maury st. Robt. Tait, cy. treas.

McKeesport, Pa.—Bids are asked until Mar. 8 for improving upper Walnut st. Cy. Engr. Smith.

Logansport, Ind.—Bids are asked until Mar. 7 for constructing a road. Geo. W. Cann, co. audt.

Racine, Wis.—Bids are asked until Mar. 5 for paving Racine st. with brick on concrete. B. P. W.

Laporte, Ind.—Bids are asked until Mar. 12 for constructing two roads. C. H. Miller, co. audt.

Brazil, Ind.—Bids are asked until Mar. 11 for constructing a gravel road. J. L. Burns, co. audt.

Richmond, Ind.—Bids are asked until Mar. 10 for grading and graveling. F. R. Charles, cy. engr.

Carmi, Ill.—Bids are asked until Mar. 7 for paving various streets with brick. Bd. local impvts.

Fowler, Ind.—Bids are asked until Mar. 8 for constructing 15 gravel roads. Lemuel Shipman, co. audt.

Kokomo, Ind.—Bids are asked until Mar. 9 for constructing gravel roads. A. B. Easterling, co. audt.

Muncie, Ind.—Bids are asked until Mar. 9 for constructing a public highway. Jos. E. Davis, co. audt.

Fairmont, Minn.—Bids are asked until Mar. 4 for constructing state road No. 1. H. P. Edwards, co. audt.

Greensburg, Ind.—Bids are asked until

Mar. 7 for constructing a macadam road. Frank E. Ryan, co. audt.

Wabash, Ind.—Bids are asked until Mar. 8 for constructing a gravel road. J. P. Noftzger, co. audt.

Columbus, Ind.—Bids are asked until Mar. 7 for constructing a macadam road. John M. Davis, co. audt.

Vincennes, Ind.—Bids are asked until Mar. 8 for constructing four gravel roads. John T. Scott, co. audt.

Peru, Ind.—Bids are asked until Mar. 9 for constructing three gravel roads. Chas. Griswold, co. audt.

Gordon, Ala.—Bids are asked until Mar. 15 for constructing 51 mis. of gravel road. W. J. Parish, co. audt.

Oklahoma City, Okla.—Bids are asked until Mar. 7 for constructing 21 mis. of additional paving. Cy. Engr. Burke.

Hartford City, Ind.—Bids are asked until Mar. 7 for constructing two gravel roads. L. W. Daugherty, co. audt.

Portland, Ore.—Bids are asked until Mar. 4 for constructing a boulevard. Cy. audt.

Olympia, Wash.—Bids are asked until Mar. 8 and 16 for macadamizing state aid roads. Henry L. Bowlby, secy. state highway bd.

Petersburg, Ind.—Bids are asked until Mar. 8 for constructing two rock roads. Frank R. Bilderback, co. audt.

Toledo, O.—Bids are asked until Mar. 4 for grading, draining and macadamizing a road. C. J. Sanzenbacher, co. audt.

Ft. Wayne, Ind.—Bids are asked until Mar. 2 for constructing "Goetin" stone road. Geo. H. Lindsmith, co. audt.

Ottawa, Kan.—Bids are asked until 5 p. m. Mar. 2 for graveling, curbing, guttering and macadamizing a number of streets; and also for paving them with vitrified brick and Imperial paving. A. H. Slater, mayor; F. A. Marcell, cy. clk.

Crawfordsville, Ind.—Bids are asked until Mar. 8 for improving a public highway. Bennett B. Engle, co. audt.

Marion, Ind.—Bids are asked until Mar. 7 for constructing macadam and brick roadways. A. Y. Stout, co. audt.

Tipton, Ind.—Bids are asked until Mar. 7 for constructing six gravel or stone roads. J. E. Barlow, co. audt.

Ft. Crockett, Galveston, Tex.—Bids are asked until Mar. 7 for constructing certain road and walks. Capt. P. Whitworth, Q. M.

Crown Point, Ind.—Bids are asked until Mar. 7 for constructing a number of gravel roads. C. A. Johnson, co. audt.

Tipton, Ind.—Bids are asked until Mar. 4 for constructing cement sidewalks, curb and gutter. W. Clyde Howard, cy. clk.

Pensacola, Fla.—Bids are asked until Mar. 10 for constructing 635,000 sq. ft. of concrete sidewalks. L. Earle Thornton, cy. engr.

Caney, Kan.—Bids are asked until Mar. 14 for paving Main, 9th, Spring and other streets with brick. R. V. Dodson, cy. clk.

Pittsburg, Pa.—Bids are asked until Mar. 8 for paving Walnut st. in Versailles twp. with brick. R. J. Cunninghom, co. audt.

Waseca, Minn.—Bids are asked until Mar. 9 for constructing 118,916 sq. ft. of paving and 7,428 ft. of curbing. John Madigan, cy. clk.

Dothan, Ala.—Bids are asked until Mar. 7 for constructing 14,000 sq. yds. of wood block, brick bitulithic and asphalt paving. Joe Baker, mayor.

Burlington, Wis.—Bids are asked until Mar. 15 for constructing 10,321 sq. yds. of brick paving and 2,500 lin. ft. of cement curb. P. J. Hurtzen, cy. engr.

Gallitzin, Pa.—Bids are asked until Mar. 5 (extension of date) for constructing about 9,000 sq. yds. of brick paving. Harry F. Conrad, boro secy.

Corydon, Ia.—Bids are asked until April 4 for constructing one-quarter of the road work for the year 1910. J. A. Wade, clk. twp. of Smith Fork.

Indianapolis, Ind.—Bids are asked until Mar. 7 for furnishing 400 tons of asphalt for use at the city asphalt repair plant. C. A. Schroeder, pres. B. P. W.

St. Paul, Minn.—Bids are asked until Mar. 7 for grading and macadamizing Centerville, Lexington ave. and Bald Eagle Lake ave. roads. E. C. Krahmer, co. audt.

Paoli, Ind.—Bids are asked until Mar. 8 for constructing 12,379 ft. of gravel or macadam roads. Wm. O. Hardman, chm. co. com'rs; Abraham B. Han, co. audt.

Oxford, N. C.—Bids are asked until Mar. 7 for constructing 20 mis. of county roads to include 3,000 cu. yds. of brick, vitrified pipe culverts. J. A. Osborne, co. engr.

Raleigh, N. C.—Bids are asked until Mar. 30 for constructing 25,000 sq. yds. of brick, bitulithic and asphalt macadam paving in Fayette and other streets. Wm. W. Wilson, cy. clk.

Ashland, O.—Bids are asked until Mar. 5 for macadamizing 3¼ mis. of roads requiring 23,900 cu. yds. of excavation and 22,015 sq. yds. of gravel macadam roadway. T. Brindle,, engr.

Canton, O.—Bids are asked until Mar. 22 for constructing about 12,300 lin. ft. of curb and 61,120 sq. ft. of flagstone walks in S. Dewalt and N. and S. Clarendon ave. P. H. Weber, cy. engr.

Corning, N. Y.—Bids are asked until Mar. 17 for constructing ½ mi. of brick paving and ½ mi. of bituminous macadam paving, with cement curb and gutters. W. C. Sleight, clk. B. P. W.

Menasha, Wis.—Bids are asked until Mar. 14 for paving Taylor, Racine and other streets with Portland cement. Separate bids will be received for paving between car tracks. Cy. clk.

Oshkosh, Wis.—Bids are asked until Mar. 3 for grading, curbing and repaving several streets with brick, creosoted blocks, cement, Blome patented granitoid, concrete, rock asphalt, sheet asphalt, or tar macadam. B. P. W.

Grand Forks, N. D.—Bids are asked until Mar. 7 for paving in districts Nos. 11, 14, 12, 13 and 16 with sheet asphalt, treated wood block, tar macadam or Donellite, bitulilthic or Blome granitoid concrete blocks. W. H. Alexander, cy. audt.

CONTRACTS AWARDED.

Peoria, Ill.—James S. Allen was awarded the contract for paving Hayes ave. with brick for $2,317.76.

Rossville, Tenn.—The contract for constructing a boulevard was awarded to the Noll Construction Co. for $419,650.

Anadarko, Okla.—The J. F. Hill Co. has been awarded a contract for more than 100,000 sq. yds. of brick and asphalt paving.

Birmingham, Ala. — (Special). The Southern Bitulithic Co. secured a contract for 75,000 sq. yds. of bitulithic pavement.

Newark, N. J.—(Special). The Standard Bitulithic Co. was awarded the contract for 50,000 sq. yds. of asphalt repairs.

Norman, Okla.—The contract for paving Main st. with Ardmore rock asphalt was awarded to the Parker-Washington Co. of St. Louis.

St. Paul, Minn.—The contract for constructing 400,000 ft. of walks and 1,500 cu. yds. of masonry was awarded to the Portland Stone Co.

Portland, Ore.—(Special). The Warren Construction Co. has been awarded the contract for 3,950 sq. yds. of bitulithic pavement in 1st st.

Spokane, Wash.—A contract for paving Lincoln st. was awarded to the Barber Asphalt Paving Co. for $50,930, and maintenance $1,305.

Knoxville, Tenn.—Horace A. Mann, of this city, secured a contract for constructing several miles of pike roads in McMinn county.

Portland, Ore.—(Special). A contract for constructing 21,629 sq. yds. of bitulithic paving has been awarded to the Warren Construction Co.

Goldsboro, N. C.—(Special). The Atlantic Bitulithic Co. has been awarded a contract for constructing 50,000 sq. yds. of bitulithic paving.

El Paso, Tex.—(Special). The Texas Bitulithic Co. was awarded the contract for 10,602 sq. yds. of bitulithic paving in S. Stanton st.

Marianna, Ark.—The contract for more paving was awarded, Feb. 15, to Contractor Petty.

Omaha, Neb.—Bids for paving and curbing in 14 districts were submitted, Feb. 15, by the following contractors: Omaha Cement Paving Co., Quannem-Decker Paving Co., Commercial Land Co., Grant Paving Co., C. E. Fanning, Hugh Murphy, E. D. Van Court, Bryant, Ford & McLaughlin, The Kettle River Co.

Ada, Okla.—The Shelby Downard Co., of Ardmore, was awarded the contract for constructing 13 blocks of paving at $1.80 a sq. yd. or $80,263.59.

Portland, Wash.—The Barber Asphalt Paving Co. was awarded a contract for paving for $374,000, and the Elwood Miles Co. a contract for $200,000.

Oconomowoc, Wis.—The contract for paving Collins and S. Main sts. with creosoted wood blocks was awarded to E. L. Bartlett, of Watertown, for $9,531.51.

Pekin, Ill.—The Springfield Cement & Construction Co., of Springfield, Ill., was awarded the contract for improving Capitol, Elizabeth, St. Mary and Sabella sts.

Cherryvale, Kan.—The contract for constructing ½ mi. of concrete curb and 4,500 sq. yds. of brick paving was awarded to John O'Leary, of this city, for $26,000.

Dallas, Tex.—(Special). The Texas Bitulithic Co. has been awarded a contract for constructing 23,085 sq. yds. of bitulithic paving in Cedar Springs st.

St. Louis, Mo.—(Special). The Granite Bituminous Paving Co. has been awarded a contract for 23,782 sq. yds. of bitulithic pavement in Connecticut ave., 22nd st. and Scanlan ave.

Omaha, Neb.—Dan Harmon was awarded the contract for paving B, C, J, 22nd, 20th and A sts. with brick block, and Jensen and Lefler the contract for paving 21st and 22nd sts. with brick block.

Alva, Okla.—(Special). A. K. Hubbard, cy. engr., says a contract has been awarded to C. A. Hemans, of Chickasha, for 15,230 sq. yds. of Trinidad sheet asphalt paving, with concrete curb and gutter, for $50,457.20.

Lewiston, Idaho—The city council has awarded a contract for paving Main st. with bitulithic for $42,465, and $10,525 for curbing and gutters. The construction company agrees to maintain the paving for the first 5 years at 2½ cents a yard annually, and the next 5 years at 2 cents a yard.

Creston, Ia.—(Special). The contract for constructing 25,000 sq. yds. of asphaltic macadam paving and 16,000 lin. ft. of cement curb was awarded as follows: Paving, Hamilton & Schwartz, of Shenandoah, Ia., $1.68 a sq. yd.; curbing, Miracle Concrete Construction Co., of Minneapolis, Minn., 34½ cts. a lin. ft.

Albany, N. Y.—Contracts for the improvement of public highways by state aid were awarded, Feb. 14, as follows: Road No. 323, Reservation-Ovid, Seneca Co., 3.86 mis., H. C. Schroeder, Rochester, $41,247; No. 350, Highland-Gardner, Ulster Co., 3.76 mis., General Construction Co., Bridgeport, Conn., $76,990; No. 5,000, Saugerties-Kingston, Ulster Co., 2.32 mis., John E. Consalus, N. Y. City, $24,685; No. 5,001, Lloyd Town Line-Milton, Ulster Co., 1.57 mis., General Construction Co., Bridgeport, Conn., $18,998; No. 397. Canajoharie-Flat Creek-Blaine, Montgomery Co., 6.67 mis., James E. Martin, Poughkeepsie, $73,454; No. 5,028, East Creek St. Johnsville, Montgomery Co., 3.75 mis.; Mohawk Engr. & Contr. Co., Schenectady, $62,980; No. 548, Berry Hill, Nassau Co., 7.59 mis., John F. Clancy, Astoria, L. I., $55,498; No. 610, Mechanicsville-Malta, Saratoga Co., 7.42 mis., Herlihy Contr. Co., Glens Falls, $87,308; No. 842, Waterford, Sec. 1, Saratoga Co., 0.27 mis., Kennedy & Easton, $3,294; No. 565, Watertown-Theresa, Sec. 1, Jefferson Co., 7.35 mis., Herlihy Constr. Co., Glens Falls, $81,850; No. 624, Carthage-Wilna, Jefferson Co., 3.09 mis., P. H. Murray, $35,185; No. 5,005, Black River-Watertown, Jefferson Co., 4.84 mis., P. H. Murray, Rochester, $59,400; No. 583, Couse-Lutha Rensselaer Co., 3.40 mis., W. M. Atchison, Troy, $37,154; No. 631, Eagle Mills-Clum's Corners, Rensselaer Co., 2.25 mis., Wm. Atchison, Troy, $23,676; No. 637, Manchester-Victor, Ontario Co., 5.30 mis., Hageman, Miller & Hageman, $48,517; No. 638, Geneva, Ontario Co., 1.02 mis., Frederick A. Brotsch, Jr., Rochester, $10,746; No. 724, Greenwich-Battonville, Washington Co., 3.98 mis., Hehlihy Constr. Co., Glens Falls, $34,749; No. 5,033, Salem-Granville, Part 1, Washington Co., 2.96 mis., R. Hopkins, Troy, $28,300; No. 728, State Line-Orangeburg, Rockland Co., 2.82 mis., H. S. Herring, Jr., & Co., Hillsdale, N. J., $32,100; No. 5.002, Congress-Long Clove, Richland Co., 1.6 mis., H. B. Sproul, Peekskill, $17,289.

SEWERS.

CONTEMPLATED WORK.

Bellefontaine, O.—A sewerage system is contemplated.

Atlanta, Ga.—Voted to issue $1,350,000 sewer bonds.

Madison, Fla.—Plans are being prepared for a sewer system.

Sand Point, Idaho—Plans will be completed Mar. 1 for a sewerage system.

Tulare, Neb.—Will vote on issue of bonds for constructing a sewerage system.

Duluth, Minn.—Plans and estimates have been completed for the Woodland ave. sewer.

Spur, Tex.—Preliminary plans for a sewerage system will be made by John B. Hawley.

Tonawanda, N. Y.—A. P. Smith, cy. engr,. has completed plans for a sewer in Rumbold ave.

Wymore, Neb.—Plans and specifications will be made for a municipal sewerage system.

Rochester, Minn.—A petition is being circulated, asking for storm sewers in W. College st.

Bowling Green, Ky.—The construction of a sewerage system is contemplated. G. E. Townsend, mayor.

Nevada, Ia.—Objections will be heard,

Mar. 21, to assessments in the Goose Lake drainage case.

Missouri Valley, Ia.—Bids will probably be received in March for constructing a sewerage system.

Hays, Kan.—Plans for a sanitary sewerage system will be made by the W. K. Palmer Co., engrs., Kansas City.

Momence, Ill.—About $30,000 will be expended in the construction of pipe and cement sewers. H. E. Vail, cy. engr.

Libby, Mont.—(Special). Montgomery G. Rice, town atty. and town clk., advises us that a sewerage system is contemplated.

Helena, Mont.—The residents in the Broadwater section have petitioned for the creation of a special improvement district in that section.

Hawarden, Ia.—A plan for a sanitary sewerage system will come up for final adoption Mar. 25. It provides for a septic tank system.

Michigan City, Ind.—The construction of a district sewer in Willard ave. is contemplated. Objections will be heard Mar. 8.

Lodi, Cal.—Plans have been accepted, and contracts will be let at once, for constructing a sewerage system. City trustees.

Leon, Ia.—Council will take final action Mar. 22 and 23 on the construction of more vitrified clay, tile or cement sewers in several streets.

Chehalis, Wash.—(Special). E. J. Hermans, cy. engr., desires information regarding concrete sewers as compared with clay products.

Vancouver, B. C.—Plans and specifications for a new sewerage system, to cost about $57,000, have been submitted. Mayor Huggins.

Des Moines, Ia.—Surveys are being made for a combined sewer system for a large area in East Des Moines. Geo. P. Poorman, cy. clk.

Hawarden, Ia.—The plan for a sanitary sewer system will come up for final adoption Mar. 25. The plan provides for a concrete septic tank.

Kansas City, Mo.—A complete topographical map of the proposed sewer system to drain 60 sq. mis., has been prepared by Jas. L. Darnell, cy. engr.

Chester, Pa.—Plans for a new sewerage system, including a disposal plant, have been submitted by Alexander Potter, cons. engr., of New York City.

Kennewick, Wash.—Preliminary steps have been taken by the city council for intalling a modern sewerage system, and the work of construction will begin about April 1.

Gastonia, N. C.—Plans and specifications for the proposed septic tank at the sewer outlet on the city farm will be prepared by the Solomon-Norcross Co., Candler Bldg., Atlanta.

Albert Lea, Minn.—(Special). Wm. Barneck, cy. engr., says plans are now being prepared for a sewerage system covering the entire western part of the city. About 9,000 ft. of pipe sewers are contemplated this season.

Omaha, Neb.—The city council committee of the whole has authorized the city engineer to proceed with the building of the necessary sewers, to the full extent of the money available, about $48,000. About $10,000 of this amount will be devoted to catch-basins, intersection work, etc.

Washington, D. C.—The Bureau of Manufacturers, dept. of commerce and labor, has information regarding certain contracts, some to be let in a large foreign city in connection with the establishment of a drainage system. Specifications will be given out soon and bids received during a period of three months after the specifications are published. The value of the machinery will be about $500,000. In applying to the Bureau of Mnfrs., for address, refer to file No. 4,521.

Washington, D. C.—Asa Phillips, supt. of sewers, has outlined a plan providing for the organization of a metropolitan district of sewerage, to construct intercepters along Rock Creek and Anacostia river from the District Boundary several miles out into the suburbs, and giving the Maryland towns the benefit of this city's fine disposal system, in order to save the above streams from pollution.

CONTRACTS TO BE LET.

Eldora, Ia.—Bids are asked until Mar. 7 for constructing tile sewers. R. A. Vigars, co. audt.

Richmond, Ind.—Bids are asked until Mar. 10 for constructing sewers. H. M. Hammond, chm. B. P. W.

Huron, S. D.—Bids are asked until Mar. 4 for constructing 12,650 ft. of 8 to 15-in. sewers. Cy. audt.

Ashley, N. D.—Bids are asked until April 4 for furnishing metal culverts of various sizes. John F. George, co. audt.

Bluffton, Ind.—Bids are asked until Mar. 26 for constructing 2 ditches. Harvey B. Sark, supt. constr., co. surveyor's office.

Ft. Sill, Okla.—Bids are asked until Mar. 7. for constructing a sewerage and drainage system. Capt. David L. Stone, Constr. Q. M.

Ft. Crockett, Galveston, Tex.—Bids are asked until Mar. 7 for constructing storm sewers at Ft. Crockett. Capt. P. Whitworth, Q. M.

Cleveland, Tenn.—Bids are asked until April 1 for constructing a sewerage system and disposal plant. Sol Norcross Co., engrs., Atlanta.

Alliance, Neb.—Bids are asked until Mar. 2 for sewer work in 5 districts and a concrete septic tank. Cy. clk.

Vincennes, Ind.—Bids are asked until Mar. 2 for furnishing plans for a general sewerage system. Mayor McDowell.

Glen Osborne, Pa.—Bids are asked until Mar. 10 for constructing 6,145 ft. of 8 and 10-in. sanitary sewers, 18 manholes and a flush tank.

Sumner, Ill.—Bids are asked until Mar. 3 for digging, enlarging and grading a ditch 6 mis. long. Henry Matthias, chm. drainage com'rs.

Louisville, Ky.—Bids are asked until Mar. 4 for constructing section "A," Castlewood sewer, contract 61. P. L. Atherton, chm. com'rs sewerage.

Burlington, Wis.—Bids are asked until Mar. 15 for constructing 4,870 ft. of 6 to 12-in. vitrified pipe, 15 manholes, etc. P. J. Hurtgen, cy. engr.

Florence, S. C.—Bids are asked until Mar. 3 for constructing a system of sanitary sewers and a disposal plant. J. K. Gilbert, bd. sewer com'rs.

Madison, Fla.—Bids are asked until Mar. 16 for constructing a sanitary sewer system, comprising 6 mis. of 6 to 15-in. pipe sewer and a disposal plant. R. H. Rowe, mayor.

Syracuse, N. Y.—Bids are asked until April 1 for the Harbor Brook improvement, 5 mis. long, including the construction of an intercepting sewer. Intercepting sewer bd.

Champaign, Ill.—Bids are asked until Mar. 5 for constructing a drain tile in Sadorus twp. David Tracy, chm. drainage com'rs, East Lake Fork special drainage dist.

El Paso, Tex.—Bids are asked until Mar. 3 for constructing refuse incinerating and sewage pumping station, force main and sewage disposal works, with appurtenances; also furnaces, pumps and machinery. Percy McGorce, cy. clk.

CONTRACTS AWARDED.

Los Angeles, Cal.—The contract for constructing the Arroyo de los Posos main sewer was awarded to Joe Chutuk.

Hill City, Minn.—The contract for the big Willow river ditch was awarded to the Kohler Constructing Co.

Kansas City, Mo.—The contract for constructing sewers in dist. No. 250 was awarded to Kinlen Bros., 3426 Michigan ave., for $13,208.

Omaha, Neb.—The contract for constructing sewer in Howard, Harney, 9th and 10th sts. was awarded to John J. Hannighen, for $15,800.

Webster City, Ia.—The contract for constructing 11½ mis. of sewer was awarded to the Tabor Construction Co., of Waterloo, for $32,000.

Montgomery, Ala.—The contract for constructing 5,900 ft. of sewer in O'Connelly and Thurman sts. was awarded to J. N. Mitchell, for $9,075.

Summit, N. J.—The contract for building sewer in Summit av. and Hill Crest was awarded to John C. Schrader, of Williamsport, Pa., for $4,871.

Kenmore, N. D.—The contract for constructing several blocks of sewer was awarded to G. V. Clark, at $1.34 for 12-in. and $1.20 for 10-in. sewers.

Chicago, Illl.—John W. Farley & Co., 134 Washington st., was awarded a contract, Feb. 2, for constructing a concrete conduit in W. 39th st., for $78,057.

Chicago, Ill.—The contract for constructing a conduit to drain the west arm of the south branch of the Chicago river was awarded to the J. W. Farley Co.

Charleston, S. C.—The contracts for constructing new sewerage extension, contracts A and B, were awarded to Guild & Co., of Chattanooga, at $27,822 and $80,672, respectively.

Omaha, Neb.—The contract for completing the Mud Creek and Jette Creek sewers was awarded to the Opperman Plumbing, Heating and Construction Co., 212 N. 25th st., South Omaha, for $140,000.

Grinnell, Ia.—Bids for constructing a sewer in North Grinnell have been submitted as follows: Guy F. Smith, Indianola, $5,232; C. E. Decatur, $5,248; The O'Farrell Construction Co., $5,335.

Erie, Pa.—The contract for constructing a sewer was awarded to Dennis O'Brien, at $1.20 a ft. for 15-in. and 35 cts. for 6-in. pipe, $1.40 for Y and T branches, and $40 for manholes.

Weatherford, Okla.—The bid of Marshall Bros., of Las Animas, Col., was the lowest submitted Feb. 11 for constructing a sewerage system, at $33,807.50, and the contract was awarded them.

Provo, Utah—The James Kennedy Construction Co., of Salt Lake City, submitted the lowest bids, Jan. 24, for constructing sewers, as follows: No. 12, 55,083 ft., $85,661; 1,176 ft. 24-in. sewer to provide outfall for sewer district No. 12, $3,737.

Salt Lake City, Utah—(Special)—Contracts for sewer extensions were awarded to the James Kennedy Construction Co. as follows, No. 220, $134,287.10; No. 249, $33,730.23; No. 253, $587.97; No. 254, $714.54. P. J. Moran was awarded the contract for constructing the City Creek aqueduct, for $25,192.08.

Seattle, Wash.—Sewer contracts have been awarded as follows: Augusta ave., J. C. Broad, $3,265; alley bet. Boone and Gardner, G. Burgie, $1,025; 5th ave., Lang & Smith, $660; alley bet. Baldwin and Ermina, G. Burgie, $5,000; 18th ave., John Fife, $10,000; Sound ave., Thos. Malony, $2,224; Lincoln st., Lang & Smith, $2,560.

Niagara Falls, N. Y.—Cusano & Dower, of this city, secured the contract for constructing a sewer in Portage road, as follows: 1,046 lin. ft. of 15-in. tile, $1.10; 1,258 lin. ft. 12-in. tile, 75 cts; 1,215 lin. ft. 10-in. tile, 65 cts; 14 manholes, each, $35; ten catchbasins, each, $35; 3,000 cu. yds. rock excavation, $2.75; total, $11,974. Other bids were: William Ruffran, Niagara Falls, $11,990; J. E. Beard, Buffalo, $13,416; George S. Nelson, Niagara Falls, $13,567; W. A. Shepard & Co., Niagara Falls, $12,426.

Niagara Falls, N. Y.—The contract for constructing a tunnel sewer in Cleveland ave. was awarded to the Read-Coddington Co., of this city, as follows: 1,230 lin. ft. of 7x9 ft. rock tunnel, $19.80; 160 lin. ft. 8x10 ft. shaft, $26; two shaft coverings, complete, $150; 100 cu. yds., overhaul, 10 cts; 40 lin. ft. 36-in. tile in concrete, $4; 15 lin. ft. 30-in. tile in concrete, $4; 20 lin. ft. 24-in. tile in concrete, $6; 85 lin. ft. 6-in. tile in concrete, 50 cts; 20 cu. yds. rubble masonry, $4; 20 cu. yds. rock excavation, $3; total, $29,347. George S. Neilson, of Niagara Falls, bid for this work $31,292.

Norfolk, Va.—F. J. McGuire was awarded a contract for constructing sewers in the streets in the Greater Ghent section, for $12,570.

WATER WORKS.

Chicago, Ill.—The Stockyards Water Co. has been incorporated, to operate a system of water works, by Horace C. Gardner, George W. Williams and Charles F. Penning.

CONTEMPLATED WORK.

Oroville, Wash.—A water works system is contemplated.

Swansboro, Ga.—A water works system is contemplated.

Brawley, Cal.—A water works system is contemplated.

Selden, Kas.—A water works system is contemplated.

Deering, N. D.—A water works system is contemplated.

Atlanta, Ga.—Voted to issue $900,000 bonds for water works.

Lonsdale, Tenn.—This town may build a water works system.

Jonesboro, Ill.—Will vote in April on the water works question.

Plainville, N. J.—A municipal water works system is contemplated.

Chester, Neb.—The installation of a water works system is contemplated.

South Bend, Ind.—The improvement of the water works system is contemplated.

New Athens, Ill.—The construction of a water works system is contemplated.

Gettysburg, S. D.—A water works system is contemplated. E. F. Gross, chm. com.

Pearsall, Tex.—A water works system is contemplated. R. W. Hudson is interested.

Geneva, N. Y.—The increase of the capacity of the water works system is contemplated.

LaCrosse, Wis.—A new water works system is advocated for this city. Ora J. Sorenson, mayor.

Cottage Grove, Ore.—The estimated cost

of the proposed gravity water works is $100,000.

Collingswood, N. J.—Will vote on the question of establishing a municipal water works system.

Charles City, Ia.—Will vote on the issue of bonds for extending the water works system.

Gilbert, Minn.—Bonds have been voted to complete the water works and electric light system.

Hood River, Ore.—Specifications are being prepared for a water works system. H. B. Langille, cy. recdr.

Liberal, Kan.—The Commercial Club is considering a proposition providing for a complete water works system.

Lorain, O.—The city council has authorized the issue of $50,000 bonds to extend the water works intake pipe.

Scandia, Kas.—Will vote Mar. 7 on the issue of $21,000 bonds to install an up-to-date system of water works.

Seattle, Wash.—Will vote Mar. 8 on the issue of bonds for enlarging and extending the city water supply system.

Centralia, Mo.—Plans are being prepared for constructing a water works and sewer system. A. Bishop Chance, mayor.

Ottumwa, Ia.—The purchase of the present water works plant or the construction of a new system is contemplated.

Lehigh, Okla.—(Special)—John Rogers advises us that he desires to purchase an electric pump of 350 gals. capacity.

Newport, Tenn.—An ordinance has been passed providing for the issue of $50,000 bonds for installing a water works system.

Monroe, Wash.—Bids will be received about April 1 for constructing a reservoir. R. V. Greene, supt. Monroe Water Co.

Coxsackie, N. Y.—The question of increasing and improving the village water supply is being discussed by the Bd. of Trade.

Jacksonville, Fla.—The board of trustees have instructed the water committee to investigate the cost of constructing a reservoir.

Millersburg, Ky.—Plans for the construction of a water works system will be prepared by F. O. Siebert, 215 E. Main st., Lexington.

Eastman, Ga.—Will vote Mar. 15 on the issue of bonds for improving the water works system and building sewers. Dr. J. D. Herman, mayor.

Libby, Mont.—(Special) — Montgomery G. Rice, town atty. and town clk., advises us that the town has under consideration a water franchise.

San Bernardino, Cal.—Plans have been completed for replacing flumes on Fairbanks ranch with pipe, aggregating about 4½ mls. Wm. Brown, w. w. engr.

Lafayette, Ga.—The city council contemplates the construction of a water works system and invites correspondence. C. J. Hammond, cy. recdr.

Norwood, O.—An ordinance has been passed providing for the issue of bonds for water works improvements, including 2 new wells and additional piping.

Morgan City, La.—(Special)—Willard Ditch, secy. bd. of trade, says this city contemplates the erection of a water works plant in the near future.

Newport, O.—The Clifton District Trustees voted to issue $12,000 bonds for the purpose of constructing a water works system in the district.

Ashford, Ala.—(Special)—J. W. McIntry, mayor, advises us that the installation of a water works and light plant is desired in that town. Population 600.

Santa Barbara, Cal.—Will vote soon on the issue of $300,000 bonds to complete the municipal water works system, to include a tunnel, reservoirs and pumping station.

Defiance, O.—(Special)—John A. Foust, prest. city coun., says this city contemplates securing the services of a capable water and light expert to examine and investigate the conditions at the present plants and advise for the best interests of the city.

Quanah, Tex.—T. L. Fountain, of the engineering firm of Fountain & Shaw, of Houston, has investigated the available water supplies for this city, and reported to the city council. His plan contemplates the damming of South Groesbeck creek, keeping the water in a narrow canyon there, and pumping it through the pipes to the city.

Louisville, Ky.—The Louisville Water Co. has directed Theodore A. Leisen, 459 8th st., chf. engr., to prepare plans and estimates for improvements, as follows: A 30,000,000-gallon vertical steam turbine-driven centrifugal pump at river station No. 1, with necessary improvements and alterations to station; a concrete and stone intake crib and tower with screen chambers for supply in both stations Nos. 1 and 2, and connection for future station when required; cleaning Crescent Hill reservoir, cementing and grouting bottom and slopes of north reservoir and construction of weir tower and improvements to conduit between reservoirs; new stable and other changes and additions to buildings at Third st., and provisions for better facilities in storing coal at Crescent Hill pumping station.

CONTRACTS TO BE LET.

Midland, Tex.—Bids are asked until Mar. 7 for constructing water works. H. B. Dunnegan, cy. secy.

Phœnix, Ariz.—Bids are asked until Mar. 14 for furnishing a pumping engine. Robt. A. Craig, supt. water bd.

Burlington, Wis.—Bids are asked until Mar. 15 for the extension of the water works system. P. J. Hurtgen, cy. engr.

Ft. Sill, Okla.—Bids are asked until Mar. 7 for constructing water works, sewers and drains. Capt. David L. Stone, Q. M.

Aberdeen, S. D.—Bids are asked until Mar. 14 for 4 and 6-in. c. i. pipe and other water supplies. F. W. Raymond, cy. audt.

Ft. Morgan, Ala.—Bids are asked until Mar. 7 for constructing 3 reinforced concrete cisterns. Capt. H. B. Chamberlain, Q. M.

Ft. Crockett, Galveston, Tex.—Bids are asked until Mar. 7 for constructing a water works distributing system here. Capt. P. Whitworth, Q. M.

Roslyn, Wash.—Bids are asked until Mar. 7 for furnishing flanged spiral riveted steel pipe and straight steel pipe for gravity water system. Cy. clk.

Vicksburg, Miss.—Bids are asked until Mar. 7 for laying 60 blocks of water mains in Cherry, Harris, Drummond and Walnut sts. J. J. Hayes, mayor.

Rock Island, Ill.—Bids are asked until Mar. 7 for a Holly pump, now at the pumping station, which this city will sell. M. T. Rudgren, cy. clk.

Portland, Ore.—Bids are asked until Mar. 8 for constructing a steel conduit 24 mls. in length from the head works to Mt. Tabor. Frank T. Dodge, supt. water bd.

Meadville, Pa.—Bids are asked until Mar. 7 for erecting a brick or cement chimney at the city pumping station. Henry Ellsworth, secy. water & ltg. dept.

Huron, S. D.—Bids are asked until Mar. 4 for constructing new c. i. water mains to replace the existing mains, and for the ex-

tension of said new iron water mains. Cy. audt.

Ft. Riley, Kas.—Bids are asked until Mar. 8 for constructing a boiler house and pump pit and installing a boiler, pumping engine and water main. Cept. W. M. Whitman, Constr. Q. M.

CONTRACTS AWARDED.

Weatherford, Okla.—The contract for water works extension was awarded to Keily, Mayfield & Shaw, of Lawton, for $25,000.

Aurora, Ill.—The American Pipe Foundry Co., of Birmingham, Ala., was awarded the contract for 8,200 ft. of 6-in. pipe and 8 hydrants.

Quincy, Ill.—The contract for a 6,000,000-gal. pumping engine has been awarded to the Platt Iron Works, of Dayton, O., for $17,980.

Minneapolis, Minn.—The contract for erecting a steel tank and tower on Lowry Hill was awarded to the Chicago Bridge & Iron Co., for $6,350.

Takoma Park, Wash.—The contract for constructing a filter plant was awarded to the Pittsburg Filter Mfg. Co., of Pittsburg, Pa., for $7,110.

Portales, N. Mex.—The contract for constructing an irrigation system has been awarded to the Western Construction Co., of Wichita, Kas., for about $350,000.

North Platte, Neb.—The contract for furnishing c. i. tunnel linings for use at the Pathfinder dam, North Platte irrigation project, Nebraska and Wyoming, for $4,346, to be delivered at Casper, Wyo.

Bloomington, Ill.—Contracts amounting to $65,000 were awarded, Jan. 28, for the improvement and enlargement of the city pumping station. The Allis-Chalmers Co., of Milwaukee, was awarded the contract for a 6,000,000-gal. Corliss pump, for $21,600; Heine Mfg. Co., boilers, set complete, $9,052; Greene Eng. Co., stokers, $2,519; Gray & Bowman, tunnel, hydraulic lift, industrial track bunkers, elevated track, grading, etc., $10,474; Heine Chimney Co., chimney, $3,751; Frank Sullivan, outside piping, $6,359, and, same company, plumbing, $1,684. The pump contract has been held up and may be awarded elsewhere.

BRIDGES.

Topeka, Kas.—Bids are asked until Mar. 7 for the extension of the Melan arch bridge. Cy. clk.

Ann Arbor, Mich.—Bids are asked until Mar. 9 for constructing a new cement bridge. B. P. W.

Rochester, Ind.—Bids are asked until Mar. 7 for the repair of a bridge. Geo. W. DuBois, co. audt.

Martinsville, Ind.—Bids are asked until Mar. 8 for constructing 4 bridges. B. E. Thornburgh, co. audt.

Cincinnati, O.—Bids are asked until Mar. 11 for constructing a concrete bridge on Bogard road. Bd. co. com'rs.

Webster, N. C.—Bids are asked until Mar. 7 for building a steel bridge at Sylva. H. R. Queen, chm. co. com'rs.

San Jose, Cal.—Estimates have been submitted for constructing a reinforced concrete bridge over Coyote creek.

Brazil, Ind.—Bids are asked until Mar. 8 for constructing 2 steel bridges and 5 concrete bridges. J. L. Burns, co. audt.

San Diego, Cal.—The city engineer has been directed to construct a bridge over the San Diego river in Mission Valley.

Greenfield, Ind.—Bids are asked until Mar. 7 for constructing a new bridge with reinforced concrete. C. H. Troy, co. audt.

Boonville, Ind.—Bids are asked until Mar. 7 for constructing 25 steel bridges with concrete backing. Ray F. Cherry, co. audt.

Winnipeg, Man.—Bids are asked until Mar. 7 for constructing the Brant street bridge. M. Peterson, secy. bd. control.

Savannah, Ga.—Bids are asked until Mar. 14 for constructing a steel highway bridge over Heeb river. G. Reuben Butler, co. clk.

Laporte, Ind.—Bids are asked until April 4 for constructing bridge over Kankakee river at English Lake. C. H. Miller, co. audt.

Columbus, Ga.—This city voted, Feb. 12, to construct a new steel or concrete bridge over the Chattahoochee river. Mayor Browne.

Rochester, N. Y.—Plans for a concrete bridge over the Genesee river at Central ave. have been prepared by E. A. Fisher, cy. engr.

Des Moines, Ia.—A contract will probably be let early this spring for building a bridge at Walnut st. John W. Budds, cy. engr.

Kalama, Wash.—Bids are asked until April 5 for constructing a steel highway bridge at Castlerock, Wash. G. S. Roberts, engr., Kalama.

Birmingham, Ala.—Maury Nicholson, cy. engr., has been directed to prepare plans and specifications for constructing a subway viaduct on 19th st.

Edmonton, Alta.—Bids are asked until Mar. 12 for constructing all steel highway bridges required during 1910. John Stochs, deputy Minister Pub. Wks.

Bradentown, Fla.—Bids are asked until Mar. 7 for constructing 4 steel bridges over bays, rivers and creeks. Robt. H. Roesch, clk. co. com'rs.

Reading, Pa.—Bids are asked until Mar. 3 for constructing a reinforced concrete arch bridge in Wyoming borough. A. L. Rhoads, co. controller.

St. Louis, Mo.—Bids are asked until Mar. 15 for reconstructing the 18th st. bridge over Mill Creek Valley. Maxine Reber, prest. B. P. I.

Oxford, N. C.—Bids are asked until Mar. 7 for raising an 85-ft. steel span 16 ft. higher and building two 75-ft. steel spans. Jas. A. Osborne, co. engr.

Seneca Falls, N. Y.—An appropriation has been made for constructing a new bridge over the canal at Ovid st. Plans and specifications have not yet been prepared.

Hutchinson, Kas.—Bids are asked until Mar. 11 for constructing a reinforced concrete arch bridge over Cow Creek. Ed Metz, cy. clk.; G. L. McLane, cy. engr.

St. Joseph, Mich.—Bids are asked until Mar. 10 for constructing a substructure for a swing bridge on Wayne st. over Momsin Channel and the Michigan Central Ry. tracks. M. Weber, cy. clk.

Wichita, Kas.—The residents of this city will vote on the issue of $40,000 for constructing a concrete bridge across Little river at 11th st. and a concrete dam across Little river at or near Central ave.

STREET LIGHTING.

Devils Lake, N. D.—A new system of street lighting is proposed.

Altus, Okla.—Voted to issue bonds to construct an electric light system.

Ft. Wayne, Ind.—Bids are asked until Mar. 7 for installing a municipal lighting plant.

Pomona, Cal.—Plans have been prepared for extensive improvements to the street lighting system.

Toronto, Ont.—Bids are asked until Mar. 8 for furnishing underground cable. G. R. Geary, mayor.

Norwood, O.—An ordinance has been passed to issue $18,000 bonds for improving the electric light plant.

Edentown, N. C.—Plans are being considered for installing a unit in the municipal electric light plant. J. C. Martin, supt.

Louisville, Ky. — Specifications have been prepared calling for 80 copper standards, of the most modern type, to be placed in Main st.

Humboldt, Tex.—The Huntswiller Light & Power Co. has closed a contract with the Fairbanks-Moore Co. for a gas producer plant and dynamo.

Drain, Ore.—An ordinance has been passed providing that a contract be awarded to the Drain Electric Light & Power Co. for a term of 20 yrs.

Green Bay, Wis.—Bids are asked until Mar. 15 for furnishing and installing electric fixtures in the new Court House. Paul Schuering, co. suyr.

Pittsburg, Pa.—The contract for incandescent lighting in the city thoroughfares has been awarded to the Sunlight Illuminating Co., 6302 Penn. ave.

Orange, Tex.—Frank D. Moses, of Trenton, N. J., has been investigating conditions here with a view of securing a franchise and establishing a gas plant.

Libby, Mont.—(Special)—Montgomery G. Rice, town atty. and town clk., advises us that the town board has under consideration an electric light franchise.

Minneapolis, Minn.—City council voted, Feb. 11, to instruct city clerk Knott to notify the Minneapolis Gas Light Co. that the city desires to purchase its plant and franchise.

Sierra Madre, Cal.—Bids are asked until Mar. 15 for the sale of a franchise to construct a gas plant and supply this city with gas for a period of 50 years. J. A. Madden, clk.

Indianapolis, Ind.—Bids are asked until Mar. 16 for furnishing and laying complete all electric lighting or gas lighting fixtures in the new City Hall. C. A. Schroeder, pres. B. P. W.

Wheeling, W. Va.—Bids are asked until Mar. 9 for constructing a fireproof power house, installing gas engines, air compressors, reservoirs, piping, et.c, and drilling a well at dams Nos. 8 and 11, Ohio river. Capt. F. W. Alstaetter, corps engrs.

Warren, O.—(Special)—Bert C. Smith, cy. engr., advises us that council, on Feb. 4, directed the director of the bd. of pub. service to ask for bids on a 16-yr. contract for municipal street lighting. Tungsten and arc systems are specified.

Grand Forks, N. D.—Bids are asked until Mar. 7 for furnishing and erecting mechanical and electrical equipment for the electric light plant. W. H. Alexander, cy. audt.

Defiance, O.—(Special)—John A. Foust, prest. cy. coun., says that city is considering the employment of a water and light expert engineer to examine the conditions here and advise as to the best interest of the city as well as to furnishing it with water and light.

Ashford, Ala.—(Special).—J. W. McIntyre, mayor, advises us that the installation of water works and light plant is desired in that own. Population 600.

Barnesville, O.—Bids are asked until Mar. 17 for lighting with electric light the streets, avenues, alleys, public grounds, public places and municipal buildings for a term of ten years. F. Waldo Hilles, vil. clk.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Atlanta, Ga.—Voted to issue $50,000 for crematories.

Salem, Ore.—The construction of a garbage crematory is contemplated.

Wenatchee, Wash.—A site has been secured for a garbage crematory.

South Bend, Ind.—The improvement of the city crematory is contemplated.

Topeka, Kas.—This city contemplates the construction of a garbage crematory. C. B. Burge, cy. clk.

San Francisco, Call.—Plans and specifications have been prepared for constructing 3 garbage crematories in the office of the city engineer, under the direction of Rudolph Hering, of New York City.

New York City—Contracts for the removal of snow in Manhattan, Brooklyn and Bronx boroughs have been awarded as follows: Manhattan, William Bradley, 1 Madison ave., at 75 cts per cu. yd.; Brooklyn, Newman & Holmes, at 54 cts. per cu. yd.; The Bronx, P. J. Kane & Co., 735 East 150th st., at 45 cts. per cu. yd.

PARKS.

Bay City, Tex.—D. P. Moore has donated a tract of six acres of land adjoining the city limits, to the city, to be used for a public park.

Newark, N. J.—A petition has been submitted to the board of trustees asking that the question of purchasing and improving land for use as a public park be voted on.

South Omaha, Neb.—The bd. of park commissioners adopted a resolution, Feb. 9, recommending that the city council issue $15,000 bonds to be used for permanent improvement of the parks.

Colorado Springs, Colo.—This city contemplates the purchase of a canon for use as a public park. An option has been secured on South Cheyenne canon, the tract including 322.35 acres and the purchase price being $317,500.

FIRE APPARATUS.

Charleston, S. C.—The purchase of a new motor fire engine is contemplated.

Olympia, Wash.—Bids are asked until Mar. 2 for a combination automobile chemical and hose truck. Cy. clk.

Tacoma, Wash.—A contract has been awarded to the Seagrove Co. for an auto attachment for hook and ladder truck No. 1, for $5,725.

Rock Island, Ill.—This city has purchased a combination automobile police patrol and ambulance from the Pope Mfg. Co., of Hartford, Conn., for $4,000.

Rochester, N. Y.—Contracts for fire apparatus were awarded, Feb. 9, as follows: 65-ft. aerial hook and ladder truck, Combination Ladder Co., of New York and Providence, R. I., $4,810; 2nd size steam engine, American La France Fire Engine Co., of Elmira, $5,800.